



CWTS BIBLIOMETRIC REPORT

Meaningful metrics

Monitoring Open Access publishing of NWO-funded research (2015-2021)

20th of July, 2022



Universiteit
Leiden

Monitoring Open Access publishing of NWO-funded research (2015-2021)

Report for the Dutch Research Council (NWO)

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DOI of this report <https://doi.org/10.5281/zenodo.7041897>

DOI of the underlying data <https://doi.org/10.5281/zenodo.7041929>

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1. Introduction

NWO has requested CWTS to analyze the extent to which research funded by NWO is made openly accessible. In 2009, NWO introduced its first open access (OA) policy, stating that publications funded by NWO should be made openly accessible ‘as soon as possible’. Following the Dutch OA ambitions presented by state secretary Sander Dekker in 2013, NWO turned its OA policy into a formal mandate in 2015. According to this mandate, all publications funded by NWO must be openly accessible at the time of publication, preferably through the gold OA route, although the green OA route is also supported.

In 2018 NWO once more updated its open access policy when it joined cOAlition S. This international group of funding councils developed Plan S, a strategy to accelerate the transition to full and immediate OA for all (peer reviewed) publications that are the result of research funded by the participating funding organizations. The requirements of Plan S apply to publications resulting from calls published by NWO or ZonMw from January 1, 2021 onward. This report covers publications from the period 2015-2021, the final year of which may include publications that are subject to the requirements of Plan S.

To monitor NWO’s progress in making the publications it funds openly accessible, this report presents statistics on the extent to which publications from the period 2015-2021 funded by NWO are openly accessible. A distinction is made between gold, hybrid, bronze, and green OA. Given the importance attached to the diamond model in the international debate about open access, we also distinguish diamond OA. The analyses presented in this report also cover publications funded by ZonMw. This report builds on two earlier reports, published in [2020](#) and [2021](#), covering publications from the period 2015-2018 and 2015-2020, respectively.

2. Methodology

Below we first discuss the databases from which data used in this study is sourced (Section 2.1), followed by the approach taken to identify publications funded by NWO or ZonMw (Section 2.2) and how the OA status of these publications was determined (Section 2.3). Finally, we discuss how we established the scope of Transformative Agreements covering Dutch institutions (Section 2.4).

2.1. Data sources

In contrast to the two previous reports, data and figures in this report are based on publications retrieved from the Dimensions database. The decision to move to Dimensions was taken because of its more comprehensive coverage of publications. Unlike Web of Science (WoS) which was used for the earlier editions of this monitor, Dimensions aims to include all publications whereas WoS applies an elaborate set of selection criteria for journals to be included.¹ In particular, the use of Dimensions for this analysis has a positive effect on the coverage of publications from the social sciences and humanities. To facilitate comparisons with the previous reports, a parallel analysis has been performed using data sourced from the Web of Science (WoS) database as well. This analysis is presented in the annex. Both the results based on Dimensions data and those based on WoS data are made available.

2.2. Identifying publications funded by NWO or ZonMw

From both the Dimensions database and the WoS database, publications funded by NWO and ZonMw were identified directly from the databases' funding and affiliation information. We considered only publications from the period 2015–2021 published in journals and classified as articles (Dimensions) or research article or review article (WoS). Books and, publications in conference proceedings, and other types of publications in journals (e.g., letters, editorials, and book reviews) were not considered, and for WoS and other types of publications in journals (e.g., letters, editorials, and book reviews) were also omitted. Within the WoS database, the following three citation indices were used: Science Citation Index Expanded, Social Sciences Citation Index, and Arts & Humanities Citation Index.

¹ <https://clarivate.com/products/scientific-and-academic-research/research-discovery-and-workflow-solutions/web-of-science/core-collection/editorial-selection-process/>

We determined the year in which a publication was published by the year in which the Crossref record for the publication was created. In exceptional cases, the journal issue in which a publication was published has an official publication date that precedes the year in which the publication's Crossref record was created. In these cases, we used the year in which the journal issue was published as the year in which the publication was published.

We identified publications funded by NWO or ZonMw by searching in the WoS database for publications that include a funding acknowledgment in which funding from NWO or ZonMw is reported. In WoS, authors of publications may refer to NWO and ZonMw in various different ways (e.g., using the full name of the funder or the abbreviated name). In order to obtain an accurate data set, we carefully identified the different ways in which authors refer to NWO and ZonMw. In Dimensions, funding information is tied to grid IDs, which we used to retrieve NWO and ZonMw funded publications. We also included publications by researchers affiliated with NWO institutes.

Some limitations of our approach need to be acknowledged. The selectivity of the WoS database in terms of coverage has already been mentioned above. Books and publications in conference proceedings are not included at all in our analyses. The lack of conference proceedings publications reduces the coverage of our analyses in particular in the field of computer science. Another limitation is that some authors may have failed to acknowledge funding from NWO or ZonMw in their publications, even though their research was in fact funded by these funders, or that funding data is missing from the database. Despite these limitations, the OA statistics in this report offer a reasonably complete overview of the extent to which publications funded by NWO or ZonMw have been made openly accessible.

2.3. Determining the Open Access status of publications

The OA status of publications was determined by linking the publication databases to the Unpaywall database. We used a snapshot of the Unpaywall database released in March 2022. For each publication funded by NWO or ZonMw, the Unpaywall database was used to determine whether the publication is OA or not, and its basic OA status. An additional source of data, the Directory of Open Access Journals (DOAJ), was then used to distinguish between journals that do or do not charge the author for publishing.

Five types of OA were distinguished:

- Diamond OA. Publications in a fully OA journal that does not charge fees.

- Gold OA. Publications in a fully OA journal that does charge fees or for which the existence of fees is undetermined.
- Hybrid OA. OA publications in a subscription journal with a clearly identifiable license.
- Bronze OA. OA publications in a subscription journal without a clearly identifiable license.
- Green OA. Publications in a journal that are also available in an OA repository (e.g., in an institutional repository or on a preprint server).

Diamond OA publications are defined as those OA publications in journals that charge no fees to both reader and author. Diamond OA journals were identified using data made available by DOAJ, with the condition that a journal requires neither an APC nor any additional fees for publishing. Subsequently, we identified diamond OA publications as publications that are classified as Gold OA in Unpaywall and that appear in one of these diamond OA journals.

Diamond, gold, hybrid, and bronze OA are mutually exclusive. Green OA may overlap with the other types of OA. For instance, if a publication in an OA journal is also available in an OA repository, the publication is both diamond or gold OA and green OA. In this report, we have chosen to classify a publication as green OA only if it is not diamond, gold, hybrid, or bronze OA. In this way, each OA publication is classified as exactly one of the five types of OA listed above.

Because bronze OA publications lack a clearly identifiable license, their inclusion in the OA statistics presented in this report might be considered debatable. We manually examined a random sample of bronze OA publications funded by NWO or ZonMw. Almost all publications in our sample seemed to be genuine OA publications, as opposed to, for instance, publications that are temporarily made openly accessible by publishers for marketing purposes. Based on this finding, we decided to include bronze OA publications in the OA statistics in this report.

Only publications made available through legal forms of OA publishing are considered in this report. Publications made available on academic social network platforms such as ResearchGate and Academia.edu or illegal websites such as Sci-Hub are not considered to be openly accessible.

There are three limitations that need to be acknowledged. First, we used Unpaywall data from March 2022. As will be shown later in this report publications continuously get deposited (for instance after the expiration of an embargo period). Second, there

may be inaccuracies in the data from the Unpaywall database. For instance, a number of OA publications may be incorrectly classified as non-OA. Third, for some of the green OA publications included in our analyses, the Unpaywall data does not make clear *when* the publication became openly accessible. We therefore do not know whether publications were made openly accessible immediately at the time of publication in a journal or at a later time. Forth, using Unpaywall data, the OA status can be determined only for publications that have a DOI. About 0.6% of the publications funded by NWO or ZonMw and indexed in the WoS database do not have a DOI. In the Dimensions database, records without a DOI constitute around 0.05% of the publications funded by NWO or ZonMw.

2.4. Establishing the scope of Transformative Agreements

Publications covered by transformative agreements (TAs) were found by first retrieving active TAs for Dutch organizations and universities from the [Journal Checker Tool dataset on Transformative Agreements](#) as developed by cOAlition S. Dutch TAs are primarily negotiated by VSNU, though a number of TAs have also been established between publishers and individual Dutch institutions, and data on these TAs were also retrieved. TA data provided by the Journal Checker Tool constitutes of journals with ISSNs and research organizations with ROR-IDs, allowing us to link these data to journals and organizations in Dimensions and WoS directly. Publications in these journals, with corresponding authors affiliated with any of the institutions in active TAs with the journal's publisher, with a publication year equal to or later than the starting year of the TA, were flagged as publications covered by active TAs.

Three limitations have to be acknowledged in this approach. First, Journal Checker Tool offers only data on currently active TAs. TAs of which the expiration date has passed are not included. The second limitation concerns the starting year of TAs: Journal Checker Tool offers no start *date*, only a starting year, of TAs, while publication date data of publications is not always accurate to the day. For these reasons, we chose to use the publication year instead, and flag publications as covered if their publication year coincides or follows the year in which a relevant TA was established. The validity of this approach was established by consulting the [ESAC Transformative Agreement registry](#), which does contain both exact starting dates as well as historical TAs (though, crucially, offers no parsable lists of involved journals or institutions), which shows that the vast majority of Dutch TAs, and virtually all TAs with large publishers, have a start date of January 1st.

Having established which publications are covered by TAs, we computed a share of these publications which is published in journal-facilitated forms of OA, these being diamond, gold and hybrid, to reflect to what extent Dutch TAs contribute to the openness of publications. Other forms of OA were not considered in this particular analysis, as they are outside the purview of TAs.

3. Findings

We first present our general findings regarding the OA status of publications funded by NWO or ZonMw (Section 3.1). We then take a more detailed look at the effects of TAs on the OA status of publications in 2021 (Section 3.2). For green OA publications, we examine which version of the publication (i.e., submitted, accepted, or published version) has been made openly accessible (Section 3.3). Subsequently we present an estimation of the share of 2021 publications that comply with core Plan S requirements (Section 3.4) and we close this chapter by having a closer look at the 10% closed publications in 2021 (Section 3.5). The data underlying the analyses presented in this chapter has been made openly available.²

3.1. Open Access status of NWO-funded publications

For each year in the period 2015–2021, the top panel in Figure 1 presents a breakdown of publications funded by NWO by their OA type (i.e., diamond, gold, hybrid, bronze, green, or closed). The overall percentage of NWO funded publications that are OA has increased from 72% in 2015 to 90% in 2021. There has been a substantial increase in the percentage of gold OA publications, from 19% in 2015 to 26% in 2021. However, the largest increase can be observed for hybrid OA publications. The percentage of hybrid OA publications has increased from 17% in 2015 to 43% in 2021. This is due to the (transformative) OA agreements that in recent years were negotiated by VSNU with many of the larger publishers. The percentage of bronze OA publications has decreased from 11% in 2015 to 3% in 2021, suggesting that publishers have become more aware of the importance of attaching a clearly identifiable license to OA publications.

The bottom panel in Figure 1 presents the corresponding statistics for ZonMw. The overall percentage of OA publications is historically somewhat lower for ZonMw than for NWO, though ZonMw has surpassed NWO in the most recent year, with the percentage increasing from 67% in 2015 to 91% in 2021. Gold OA publishing is more common for ZonMw than for NWO (43% vs. 26% in 2021), while green OA publishing is less common (4% vs. 14% in 2021).

² Data available here: <https://doi.org/10.5281/zenodo.7041929>

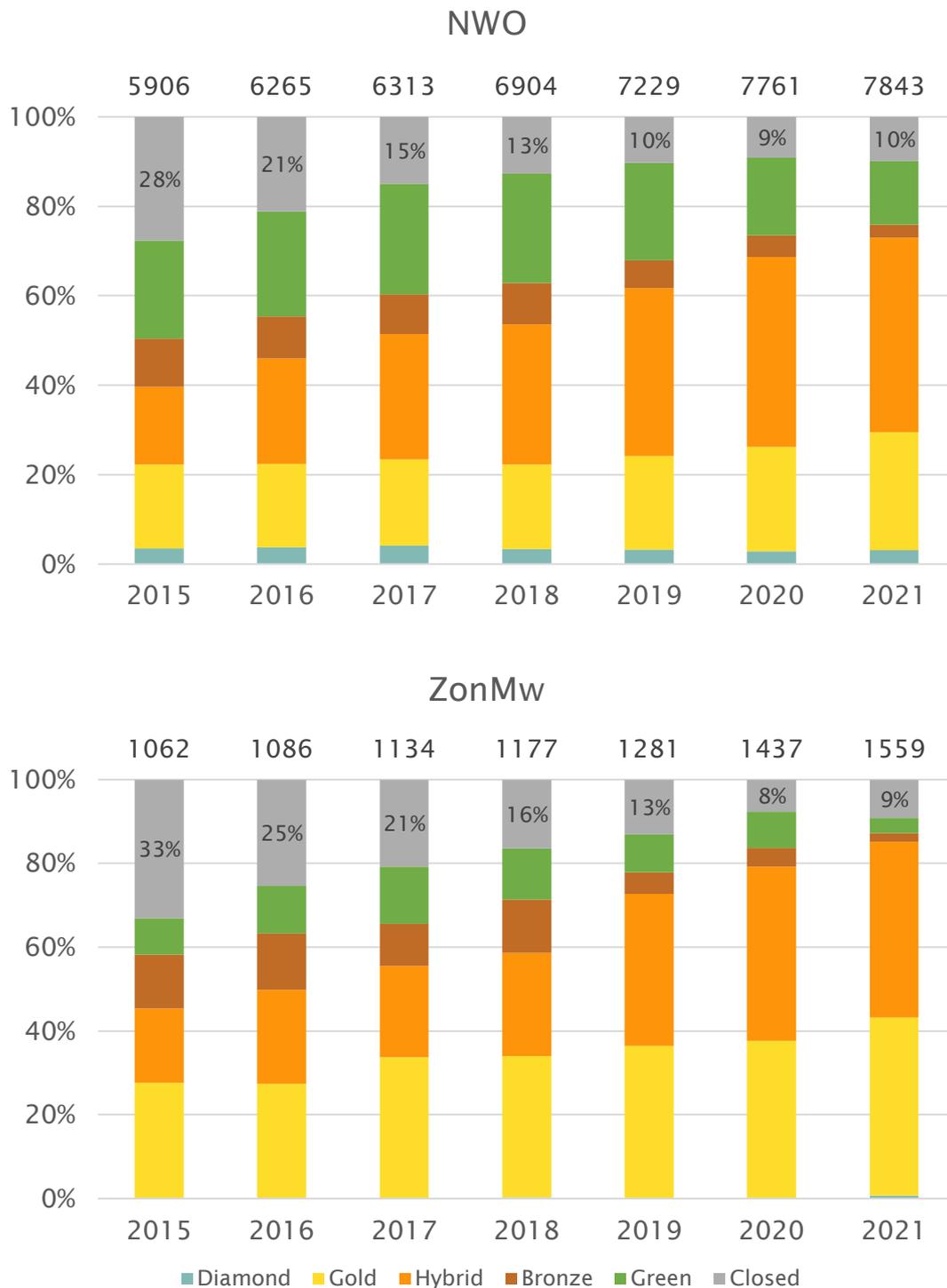


Figure 1. For each year in the period 2015–2021, the bar charts show the number of publications funded by NWO (top panel) or ZonMw (bottom panel) and the percentage of publications of the different OA types.

The OA statistics presented in this report show whether publications were openly accessible at the time of the release of the Unpaywall database (i.e., March 2022). They do not show whether publications were made openly accessible immediately at the time of publication. This means that time trends need to be interpreted with some care. Figure 1 shows that both for NWO and for ZonMw the percentage of green OA publications is lower in 2021 than in 2020. This is likely to be due to the effect of embargoes imposed by many publishers. Publications from 2020 made openly accessible in a repository after the expiration of an embargo (or, alternatively, under the Taverne Amendment in the Dutch Copyright Act) are counted as green OA publications in our analysis, while similar publications from 2021 for which the embargo has not yet expired are counted as non-OA publications.

For three main fields of science, Figure 2 presents a breakdown of publications funded by NWO or ZonMw by their OA type. The statistics are based on publications from 2021. The three main fields are Natural Sciences, Biomedical and Health Sciences, and Social Sciences and Humanities³.

³ The field definitions were obtained from the [Leiden Ranking](#). Natural Sciences combines the Leiden Ranking fields Physical Sciences and Engineering, Mathematics and Computer Science, and Life and Earth Sciences.

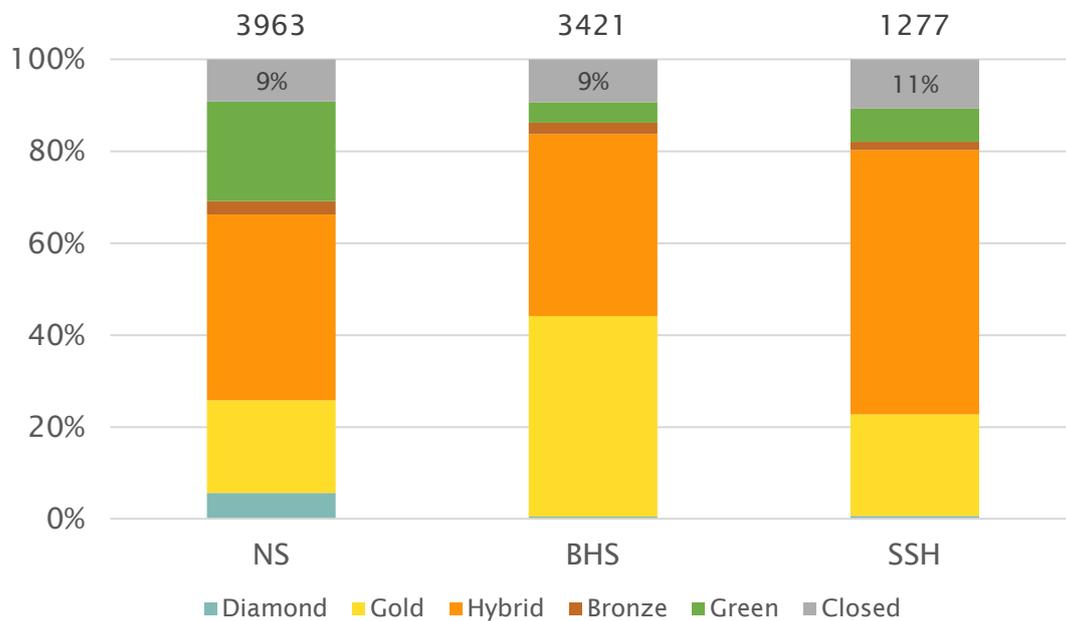


Figure 2. For each main field, the bar chart shows the number of publications funded by NWO or ZonMw and the percentage of publications of the different OA types. Only publications from 2021 are considered. NS: Natural Sciences; BHS: Biomedical and Health Sciences; SSH: Social Sciences and Humanities.

The overall percentage of OA publications is quite similar for the three main fields, ranging from 89% in the Social Sciences and Humanities to 91% in the Natural Sciences. As in last year's analysis, gold OA publishing remains much more common in the Biomedical and Health Sciences (44%) than in the Natural Sciences (20%) and the Social Sciences and Humanities (22%). Diamond OA publishing, however, occurs almost exclusively in the Natural Sciences (6%), with very infrequent occurrences in the two other fields (<1%). This may come as a surprise, given the broad interest from the SSH community in this specific OA publishing model. Green OA publishing plays only a modest role in the Biomedical and Health Sciences (4%) and the Social Sciences and Humanities (7%). It plays a much more important role in the Natural Sciences (22%), reflecting the long tradition in some of the natural sciences of posting publications on preprint servers such as arXiv.

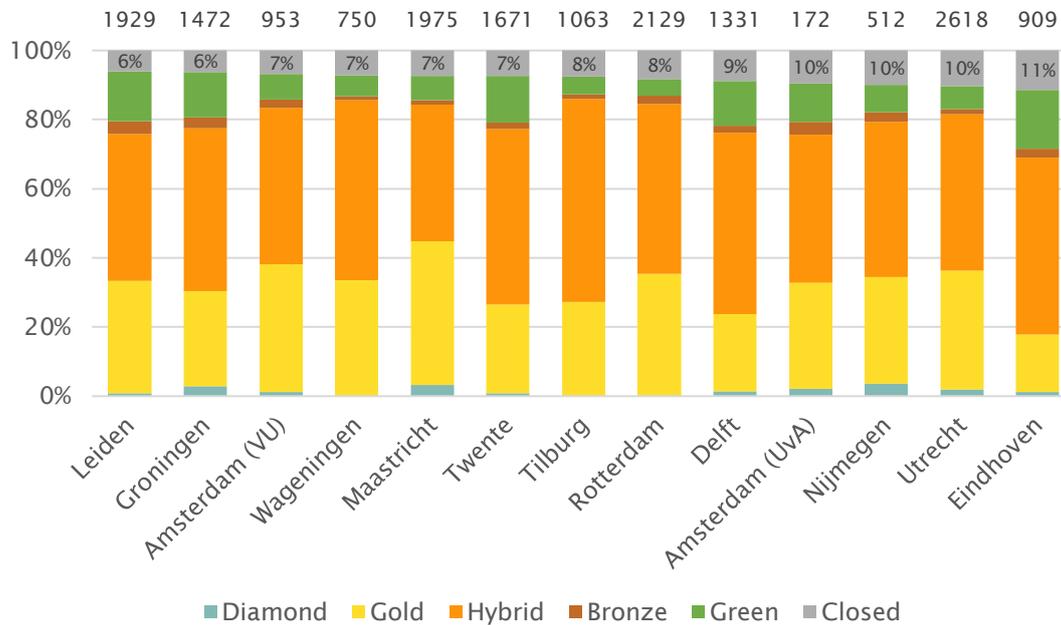


Figure 3. For each Dutch university, the bar chart shows the number of publications funded by NWO or ZonMw and the percentage of publications of the different OA types. Only publications from 2021 are considered.

Most publications funded by NWO or ZonMw are authored by researchers affiliated with Dutch universities, including the university medical centers. For each of the Dutch universities, Figure 3 presents a breakdown by OA type for publications funded by NWO or ZonMw and published in 2021. Publications with multiple affiliations are counted as full publications for each participating university. The overall percentage of OA publications is relatively similar for all universities, ranging from 89% for Eindhoven University of Technology to 94% for Leiden University and the University of Groningen. However, there are substantial differences between universities in the way in which they make their publications openly accessible. In particular, the large differences in green OA publishing are noteworthy. The percentage of green OA publications ranges from 5% for Tilburg University and the Erasmus University Rotterdam to 17% for Leiden University. Another notable difference is the uptake of gold OA publishing, ranging from 17% for Eindhoven University of Technology to 42% for Maastricht University.

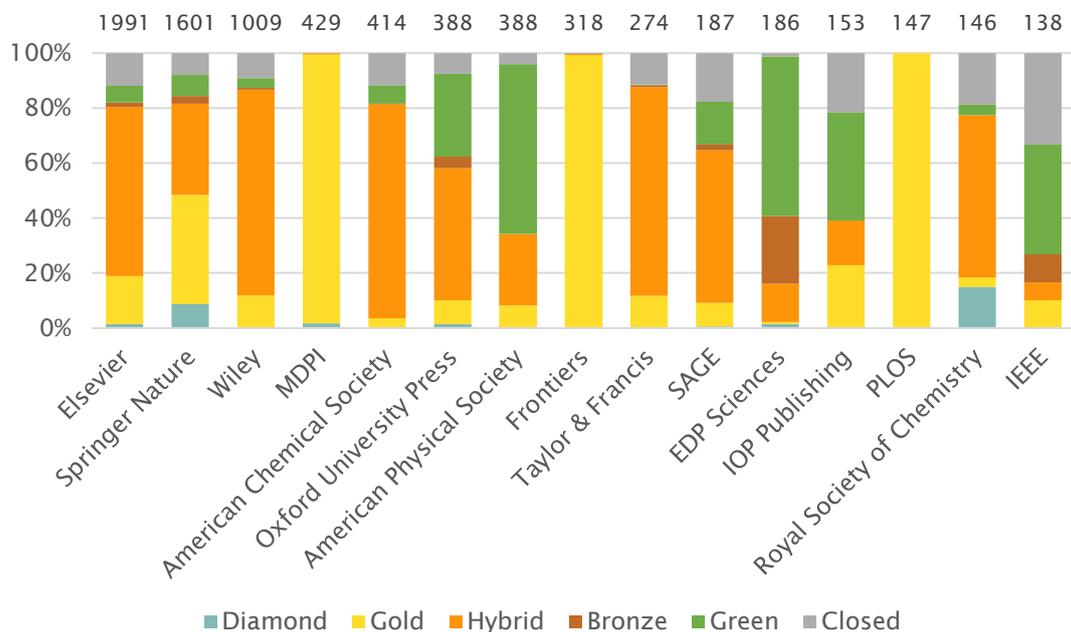


Figure 4. For each publisher, the bar chart shows the number of publications funded by NWO or ZonMw and the percentage of publications of the different OA types. Only the 15 publishers with the largest number of publications funded by NWO or ZonMw are included in the chart. Only publications from 2021 are considered.

We now turn to statistics at the level of publishers, focusing on the 15 publishers that published the largest number of publications funded by NWO or ZonMw in 2020. For these publishers, Figure 4 presents a breakdown of publications funded by NWO or ZonMw by their OA type. The figure includes three gold OA publishers, MDPI, Frontiers, and PLOS, for which all publications are openly accessible. For the other publishers, the percentage of OA publications ranges from 67% for IEEE to 99% for EDP Sciences. The effects of the (transformative) OA agreements negotiated by VSNU with many of the larger publishers are clearly visible. In the case of Elsevier, which published the largest number of publications funded by NWO or ZonMw, a mere 12% of the publications are still closed, while this percentage was over 20% two years prior. American Physical Society and EDP Sciences have more than 90% OA publications, but the majority of their publications (58% and 62% respectively) are green OA. Diamond OA is clearly concentrated with a few publishers, primarily Springer Nature (9%) and the Royal Society of Chemistry (15%).⁴

⁴ Note that the OA status of a few journals are apparently misclassified, as MDPI is a pure-gold publisher, yet a small number of diamond OA publications appear. This is due to the journal Applied Science incorrectly being flagged as requiring no APC in DOAJ.

Diamond Open Access

Thanks in part to the large-scale [Diamond OA study](#) conducted last year by cOAlition S in collaboration with Science Europe, there is an increased attention for diamond OA. Diamond OA refers to Open Access journals and platforms that are free to both authors and readers. Authors are not faced with publication fees. Any costs are covered by other sources (often from institutional funding). NWO is a supporter of the diamond open access model and therefore supports, for example, initiatives such as Sci-Post and the diamond open access platform www.openjournals.nl. In this edition of the monitor, we have tried to map to what extent NWO and ZonMW funded research is published in diamond OA journals or platforms.

The total number of diamond OA publications in the period 2015-2021 is 1651, 3.0% of the total number of NWO or ZonMw publications. In 2021 we find 251 diamond OA publications, 2.8% of the total.

The overview below provides the top 10 most common publishers and journals. Journals participating in the [SCOAP3](#) consortium coordinated by CERN constitute by far the largest share of publications in diamond OA journals.

Publisher	Journal	Publications (2015-2021)	Publications (2021)
Springer	Journal of High Energy Physics*	568	78
Springer	European Physical Journal C*	377	56
Elsevier	Physics Letters B*	267	24
Royal Society of Chemistry (RSC)	Chemical Science	89	17
Stichting SciPost	SciPost Physics	68	16
EDP Sciences	EPJ Web of Conferences	61	3
Copernicus GmbH	Earth System Science Data	29	13
Elsevier	Nuclear Physics B*	21	2
Centers for Disease Control and Prevention	Emerging Infectious Diseases	11	2
Beilstein Institut	Beilstein Journal of Nanotechnology	11	0

* SCOAP3 journals

3.2. The effect of Transformative Agreements

Agreements negotiated by VSNU / UKB with publishers typically apply only to publications that have a corresponding author affiliated with a Dutch university. 54% of the publications funded by NWO or ZonMw and published in 2021 have a corresponding author affiliated with a Dutch university or some other organization in

the Netherlands. For these publications, Figure 5 presents a breakdown of OA status and TA coverage. Publications covered by TAs are marked in purple, with the bar chart representing the shares per publisher. For publications in journals not covered by TAs, shares of OA types are displayed instead.

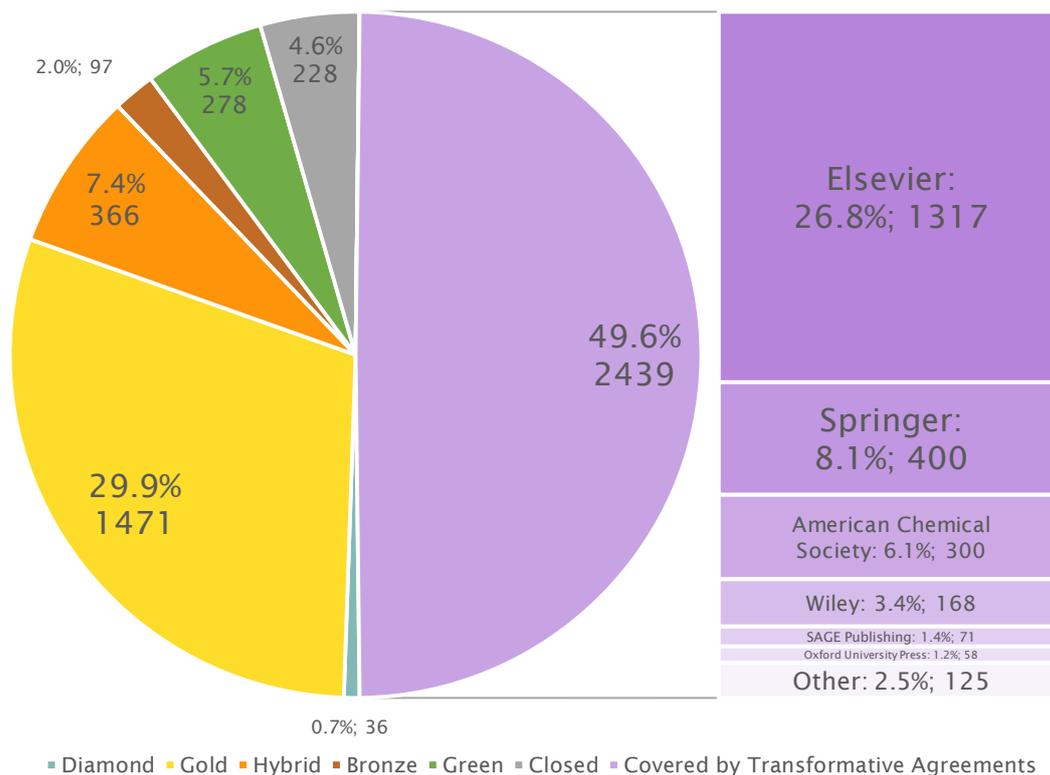


Figure 5. Number of publications covered by TAs, and OA shares for publications not covered by TAs. Only publications from 2021 with Dutch corresponding authors are included, for a total of 4915 publications.

It has to be noted that not all publications published in journals covered by TAs are, in fact, open access. A manual inspection of the data revealed that a number of publications within this subset are incorrectly flagged as non-OA within the Unpaywall data set used.

Noteworthy is the proportion of publications in hybrid journals that are outside the TAs, consisting 366 publications (7.4%). These publications are not compliant with Plan S if not via the green route and since 2015 NWO has not allowed its funds to be used for these publications. Further study should show from which resources researchers pay for these publications.

3.3. Licenses and versions of open access publications

For diamond, gold and hybrid OA publications funded by NWO or ZonMw and published in 2021, Figure 7 presents a breakdown by license. 73% of the publications has a CC-BY license, the most liberal of the CC licenses. The remaining publications almost all have a CC-BY-NC or CC-BY-NC-ND license. There are a few publications that have a CC-BY-SA or CC-BY-NC-SA license or a publisher-specific license.

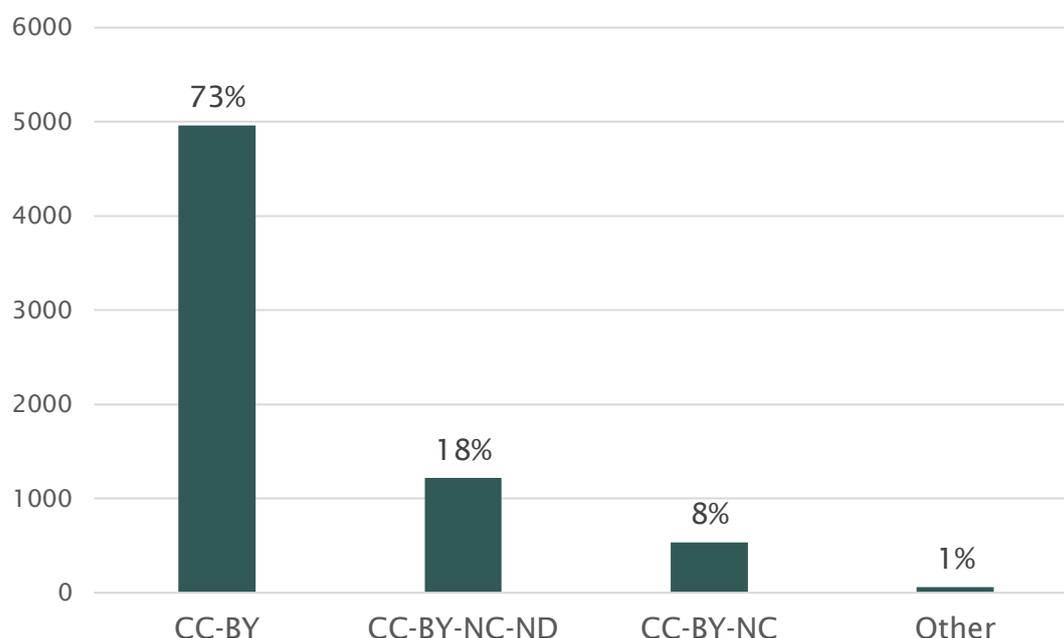


Figure 7. Bar chart showing a breakdown by license for diamond, gold and hybrid OA publications funded by NWO or ZonMw and published in 2021.

The CC-BY-NC license and its more restrictive variants are not compliant with Plan S. Publishers for which a substantial share of the publications have a CC-BY-NC license, or a more restrictive variant of this license, include American Chemical Society (95%), Taylor & Francis (81%), Royal Society of Chemistry (60%), Wiley (56%), Oxford University Press (48%), SAGE (29%) and Elsevier (18%). Given that agreements exist with all of these publishers, there seems to be room for improvement in negotiating compliant license arrangements in the new transformative agreements. In the case of the green OA route, Plan S requires the accepted version ('author accepted manuscript') or the published version ('version of record') of a publication to be made openly accessible in a repository. According to Unpaywall data, for 37% of the green OA publications funded by NWO or ZonMw and published in 2021, the published version has been made available in a repository. For 12%, the accepted version has been made available. For the remaining 51%, only the submitted version has been posted in a repository,

which is not compliant with Plan S. We note that these statistics need to be interpreted with caution, since Unpaywall may not always be able to accurately distinguish between the submitted, accepted, and published version of a publication.

3.4. Further analysis of closed publications

Section 3.1 of this report shows that in 2021, 10% of publications resulting from NWO or ZonMw funding remain closed. Since the aim is to reach 100% OA, it is important to investigate what constitutes this remaining 10% share of publications. If common barriers are found that prevent publications from being OA, targeted measures may be taken to alleviate these. We have drawn a random sample of 90 publications out of the 899 publications that are still closed access according to our analysis and manually assessed why these are closed, or whether there might be deficiencies in the data. Figure 8 presents the summary of this analysis.

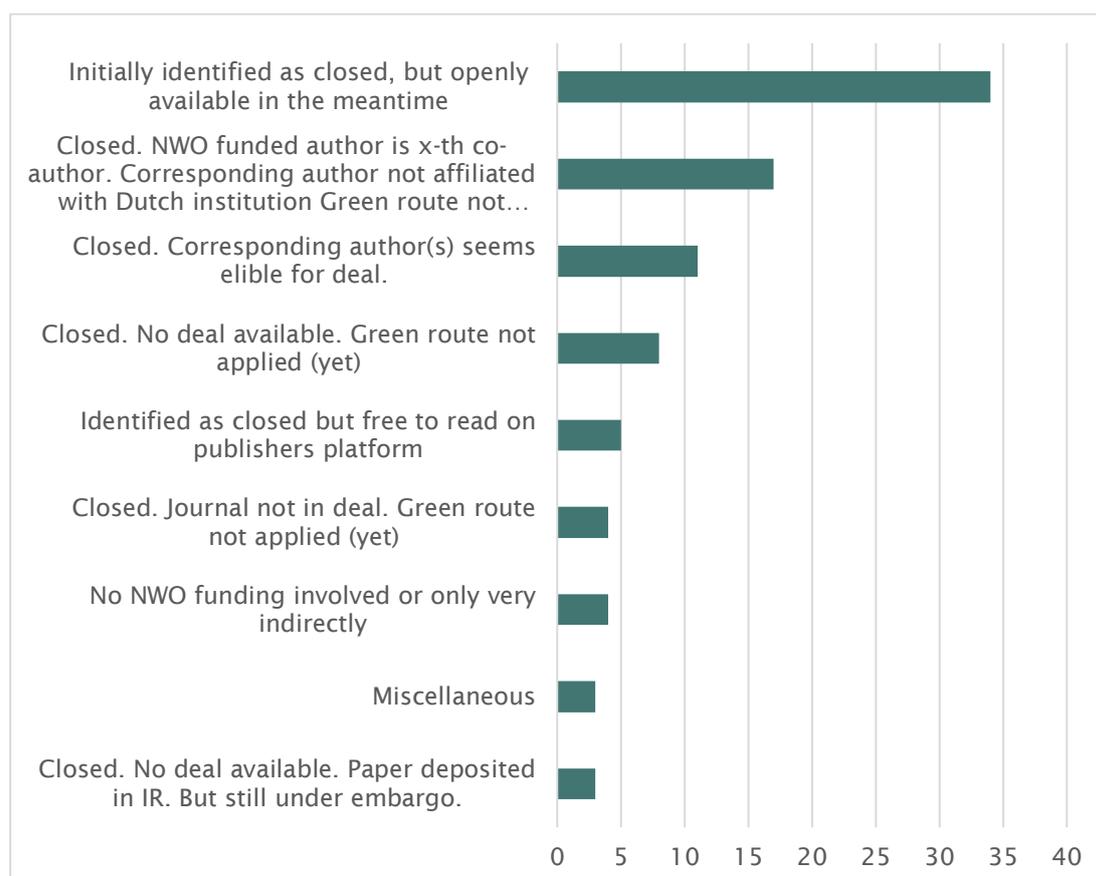


Figure 8. Summary of manual inspection of 90 closed publications.

The following conclusions can be drawn:

- Most importantly, a substantial number of publications seem to be wrongly identified as closed. Around 42% of articles we checked were actually openly available. Most (n=34) were made openly available through institutional repositories (IRs) of universities, often under the Taverne amendment, and should qualify as green OA. A small number (n=5) of papers was free to read on the publisher's website but not openly licensed, qualifying as bronze OA which Unpaywall may have trouble correctly detecting. The most likely explanation for this high number is the time between the date of the snapshot for this analysis (March 2022) and the moment this spot check was performed (July 2022). A substantial number of papers were made open access in these months, testimony to the dynamic nature of this field. The remaining publications (n=50) proved to be truly closed access.
- The largest group of closed-access publications (n=17) can be classified as papers in which the NWO or ZonMw funded author is a co-author—sometimes among a very large group of authors—who may have little influence on the choice to publish OA. These publications still fall within NWO's and ZonMw's OA mandate and can (and should) still be made open access by applying the green route. In some cases (n=3) we see that these authors have indeed uploaded their paper to the IR of their home institution, but the paper is still under embargo.
- Another category (n=11) concerns papers that are closed access in journals for which a TA is in place for which the corresponding author(s) seem to be eligible. This could be classified as “missed opportunity” closed access.
- Another group of publications occur with publishers where no national TA is available (n=7) or in specific high impact journals (n=4) which are not included in the national TAs (like Nature and Cell Press journals). Here the green route can and should be applied to make these publications openly available. We can only speculate as to why this has not yet been done by the authors.

3.5. Estimating Plan S compliance

Whether any individual publication complies with all Plan S requirements is difficult to ascertain with the data currently available to us, but we can make an estimation of Plan S compliance across the entire dataset of NWO and ZonMw funded publications in 2021. We estimate Plan S coverage of 2021 publications using the following criteria:

- A publication is either diamond or gold OA and uses a CC-BY license
- A publication is hybrid OA, CC-BY license and published in a journal covered by a TA
- A publication is green OA, the available version is the published or accepted version of the manuscript, and its OA date is the same as or earlier than its Crossref creation date.

Note that in our analysis so far, we have counted as green OA only those publications that are neither diamond, gold, hybrid or bronze. For this particular analysis, however, green OA status is still considered for bronze and hybrid OA publications, which means that a hybrid OA publication not in a TA journal, or any bronze OA publication, may still satisfy our criteria if it is also green OA and passes the other green OA compliance requirements.

Using the above criteria, at least 58.2% of publications funded by NWO or ZonMw in 2021 satisfy these core Plan S requirements. This percentage increases to 59.7% if a grace period of one week between publication date and green OA availability is observed. Some publications lack a definitive OA date, and for these, green 0-month embargo compliance cannot be fully determined. If we assume that these do comply, overall compliance rises to 63.6% or 64.6% if a one-week grace period is observed. An overview by compliance reason can be found in Table 1.

Table 1. Compliance state estimate of NOW and ZonMw funded publications in 2021.

Compliance state	Publications	Share
Gold / diamond route	2464	27.1%
Hybrid + TA route	1412	15.5%
Green 0-month embargo route	1413	15.6%
Green route missing OA date	494	5.4%
Non-compliant	3303	36.4%

Limitations to this approach include the lack of information on whether publications satisfy the requirement for openness of metadata, and missing OA dates in Unpaywall. This latter issue is improving, and as of 2021, 78.0% of Unpaywall records include the date on which the record became available. A missing OA date makes it impossible to determine whether the green 0-month embargo route was properly followed, and this affects 494 (5.4%) of publications in 2021.

4. Conclusions

We have analyzed the extent to which publications funded by NWO or ZonMw, including publications of the NWO institutes, are openly accessible. 90% of the NWO publications and 91% of the ZonMw that were published in 2021 are openly accessible. This is a substantial growth relative to 2015, the first year covered by our analyses. Around 70% of the NWO and ZonMw publications from 2015 onwards are openly accessible. Most OA publications are openly accessible on the platform of the journal publisher, typically as gold or hybrid OA and sometimes as diamond or bronze OA. A smaller share of the OA publications have instead been made openly accessible in a repository (i.e., green OA). The green OA route is relatively popular in the natural sciences. It is used less often in the biomedical and health sciences and the social sciences and humanities. Further growth in the percentage of OA publications can be expected as a result of Plan S. An increasingly large share of the NWO and ZonMw funded publications will be subject to the requirements of Plan S, and NWO and ZonMw grantees will be able to benefit from recent developments such as the Plan S rights retention strategy.

Transformative agreements (TAs) play a key role in increasing OA publishing in the Netherlands, including OA publishing by NWO and ZonMw grantees. We estimate that 26.8% of the NWO or ZonMw funded publications from 2021 were published in a journal covered by a TA. When considering only publications with Dutch corresponding authors, this percentage increases to 49.6%. We found that most of these publications are indeed openly accessible.

The requirements of Plan S apply to publications resulting from calls published by NWO or ZonMw from January 1, 2021 onward. A substantial share of the publications classified as OA publications in our analyses do not meet the requirements of Plan S yet. This applies to gold and hybrid OA publications that have a CC-BY-NC license, or more restrictive variants. It also applies to hybrid OA publications in journals not covered by a TA. Bronze OA publications do not meet the Plan S requirements at all, since license information is missing for these publications. Green OA publications meet the Plan S requirements only if the accepted or published version, not just the submitted version, is openly accessible in a repository, and only if the publication is posted in a repository immediately at the time of publication in a journal (i.e., no embargoes).

We do not have enough information to calculate the exact percentage of publications funded by NWO or ZonMw that meet the Plan S requirements. However, based on the information presented in this report, we estimate that about 58.2% of the publications published in 2021 meet the core requirements of Plan S. This percentage is lower when the technical requirements of Plan S, such as openness of metadata, are taken into account as well.

4.1. Recommendations for improved monitoring of open access publishing

As discussed in Chapter 2, the methodology for monitoring OA publishing used in this report has a number of limitations. To address these limitations, we offer a few recommendations for improved monitoring of OA publishing:

- Plan S mandates publishers to make high-quality metadata on scholarly publications openly available, and it strongly encourages the use of persistent identifiers. We recommend NWO to strictly monitor compliance with these requirements and to include the mandatory use of persistent identifiers in future negotiations by VSNU / UKB with publishers. The metadata should include data on funders, grants, institutions, and licenses. It should also include links between the different versions of a publication (i.e., the version published in a journal and versions posted in a repository). The metadata should be made openly available through Crossref (or other similar infrastructures). High-quality open publication metadata will greatly simplify monitoring of OA publishing, especially when persistent identifiers are used. The use of open publication metadata is also recommended in a [briefing paper on OA monitoring](#) published by Science Europe.
- We support the recommendation made in the [NWO Persistent Identifier Strategy](#) to adopt persistent identifiers for grants and to make metadata for grants openly available through Crossref. Publishers can then be requested to use these persistent identifiers in the metadata they deposit to Crossref. This will simplify monitoring of compliance by grantees with NWO's OA policy.
- Monitoring OA publishing based only on external data sources such as Crossref or Dimensions will inevitably give an incomplete picture, because grantees do not always properly report the funding of their research in their publications. The quality of OA monitoring can be improved by combining the use of external data sources with the use of an internal data source. NWO has an

internal database in which grantees are required to register the publications resulting from their NWO funded projects, but the quality and completeness of the data are uncertain. For future monitoring of OA publishing, we recommend to NWO to improve the internal infrastructure for registering publications (and other outputs) resulting from NWO funded projects. We also recommend to consider the possibility of integrating such an infrastructure into an [Open Knowledge Base](#) for Dutch research organizations.

Annex A: Comparison of Dimensions and Web of Science data

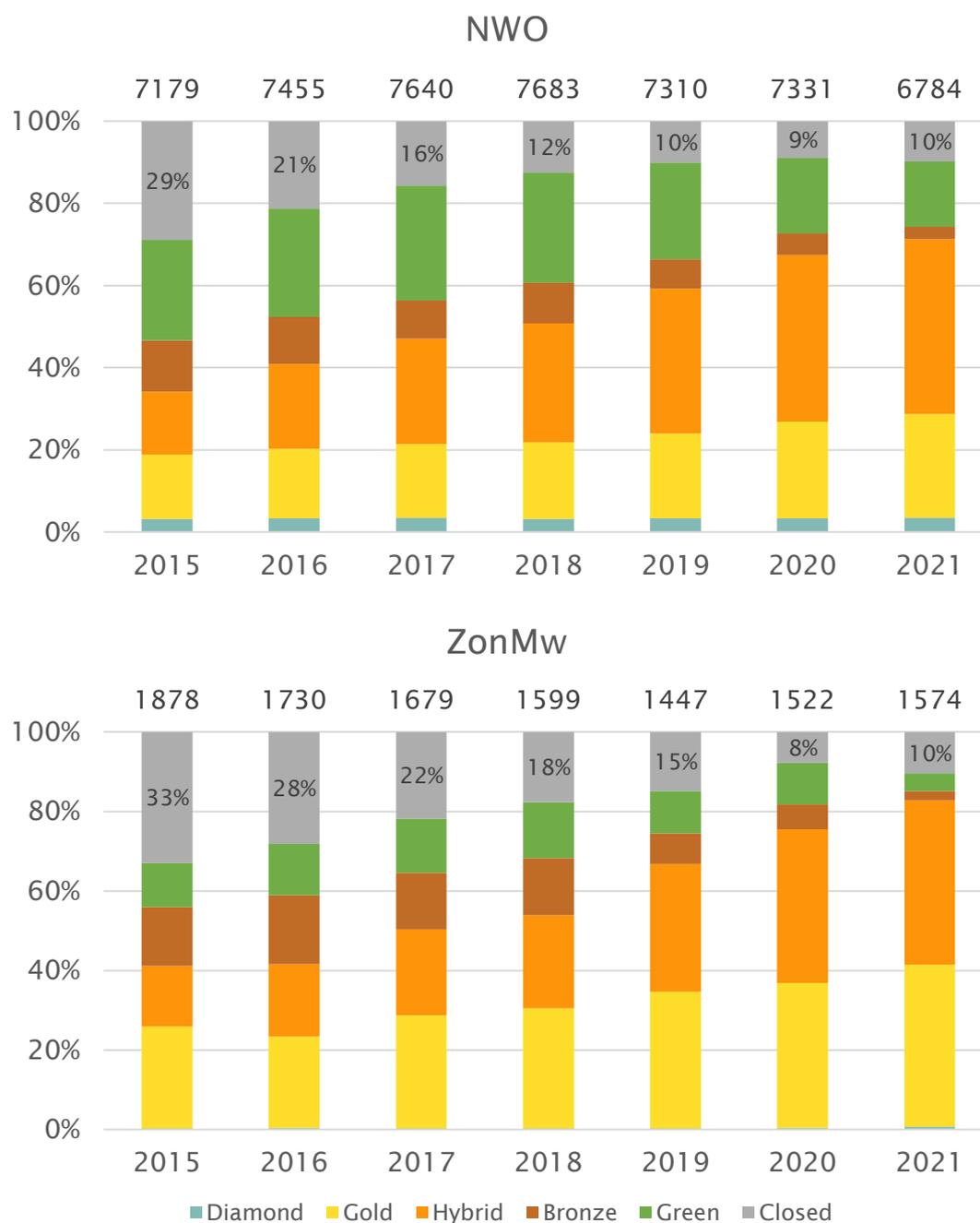


Figure 9. For each year in the period 2015-2021, the bar charts show the number of publications funded by NWO (top panel) or ZonMw (bottom panel) and the percentage of publications of the different OA types, based on WoS data.

Figure 9 contains a reproduction of Figure 1’s OA type shares over time, using WoS as primary data source instead of Dimensions. When comparing with Figure 1, we can see that trends of OA type shares are virtually identical, with no major outliers. Actual type shares do differ, though in recent years by less than a percentage point on average. Publication counts do differ significantly between WoS and Dimensions, with Dimensions recording fewer publications funded by NWO and ZonMw than WoS on average, though an important note to be made here is that this difference becomes smaller with time and that in the most recent two years, the number of publications funded by NWO retrieved from Dimensions actually exceeds that of WoS. This shows that a transition to Dimensions data, especially for increased coverage of more recent publications, is sensible.

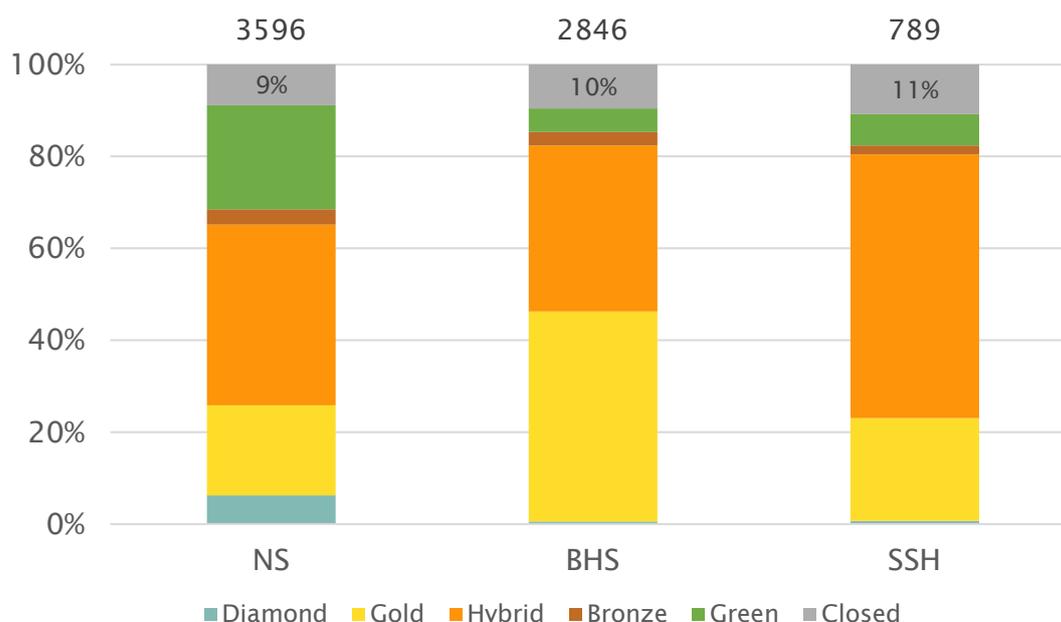


Figure 10. For each main field, the bar chart shows the number of publications funded by NWO or ZonMw and the percentage of publications of the different OA types. Only publications from 2021 are considered, based on WoS data. NS: Natural Sciences; BHS: Biomedical and Health Sciences; SSH: Social Sciences and Humanities.

Another frequently mentioned advantage of Dimensions over WoS is its increased coverage of the Social Sciences and Humanities disciplines. Figure 10 contains a reproduction of Figure 2 using WoS data. When comparing these two figures we can clearly see that not only do we find more publications across all disciplines in Dimensions for the year 2021, this increase is most profound in the SSH field. Overall shares of OA types across fields are similar between Dimensions and WoS.