

Societal impact of research financed by RCN

What can altmetrics tell us ?

Analysis for the Annual Report 2021

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Department for statistics and evaluation

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1 Introduction

The Research Council of Norway (RCN) is the Government's main instrument for implementing public research policy in Norway. Around one fourth of public spending on R&D is directed through RCN who finances both basic and applied research for all sectors and across thematic areas and disciplines. RCN reports on its activities and achievements in an annual report to Ministry of education and research. The requirements of the report are set out in a system for the management by aims and results (MRS) identifying themes for reporting for each year.

For the year 2021. the ministry asked the Research council to include an assessment of the societal impact of RCN-funding in two prioritised areas of the Norwegian long-term plan for research and higher education: "Seas and oceans" and "Climate, the environment and clean energy".¹

Historically, RCN has used various methods to document and assess the societal impact of its investments in research, such as econometrics, case studies and career tracking. The emphasis has been on qualitative assessment and in most cases required additional data collection because relevant data has not been readily available in RCN case handling systems or other sources. Such data-collection is time-consuming and costly. For the annual report 2021 RCN thus decided to run a pilot exercise on the use of *altmetrics* to assess the societal impact of RCN-funding in the prioritised areas of "Seas and oceans" and "Climate, the environment and clean energy".

Altmetrics are metrics and qualitative data that are complementary to traditional, citation-based metrics. They can include (but are not limited to) citations on Wikipedia and in public policy documents, discussions on research blogs, mainstream media coverage, bookmarks on reference managers like Mendeley, and mentions on social networks such as Twitter.² RCN decided to use altmetric data that has sourced from the Web by the Digital Science in the database altmetric.com. This is by our knowledge the most comprehensive and well documented database for Web-based altmetrics-data available.

In addition to serving the needs of RCN annual reporting, the present study was run as a pilot to answer the following questions:

Question A: What can altmetrics tell us about a specific funding portfolio at RCN?

Question B: What may be the role of altmetrics in documenting the societal impact of RCN-funding?

In chapter 2 we will present the data and methods used before presenting the main results in chapter 3. A discussion and conclusion of the study with respect to future use of altmetrics in documenting the societal impact of RCN-funding (question B) is found in chapters 4 and 5. Data sources for two of the most relevant types of citing documents, news outlets and policy documents are specified in the Appendices.

¹ [Long-term plan for research and higher education 2019–2028 — Meld. St. 4 \(2018–2019\) Report to the Storting \(white paper\)](#)

² <https://www.altmetric.com/about-altmetrics/what-are-altmetrics>

2 Data and methods

RCN routinely tag all funded projects based on a controlled vocabulary covering different project properties like, scientific discipline, research theme and relevance to LTP-goals. Projects expected to contribute to the selected societal goals was identified through tags corresponding to the two goals of interest: Climate, environment and environment-friendly energy (LTP=KMM) and Seas and Oceans (LTP=Hav). In this report we will use the standardised abbreviations in RCNs system for tagging projects ('KMM' and 'Hav') to designate the relevant sets of projects and publications. Data on relevant projects was retrieved from RCN's data warehouse. Project data include information on funding types [søknadstype] which was the main independent variable used in the analysis of each thematic area. The analysis were performed at both the publication and the project levels.

We extracted all publication from the relevant projects in the period 2015-2021. which corresponds to the period when the current Long-Term Plan for research and higher education³ (LTP) has been in effect. This included projects that had started before 2015 and projects with funding beyond 2021. Citing information for these publications was retrieved from Altmetric.com on 20 December 2021 based on the unique Digital Object Identifiers (DOIs) of the publications reported to RCN. This reporting is being done by project managers at the research performing institutions through the Current Research Information System in Norway (Cristin). We did not use data on funder attribution provided in the Dimensions database.

There was some overlap between the two sets of publications because some projects were tagged as relevant for both societal goals. Among the 9520 publications retrieved altogether for KMM (6540) and Hav (2980), 1092 were present in both datasets.

2.1 Data coverage

The Altmetric database covers a range of online sources capturing attention relating to research outputs through citations.⁴ We can estimate the data coverage by looking at shares of RCN publications that are identified with DOI in the underlying academic publications database Dimensions (see Table 1 below). Between 59 percent (Hav) and 69 percent (KMM) of the publications reported to RCN were found in Dimensions. Among these, between 72 percent (Hav) and 76 percent (KMM) had one or more mention in the Altmetric-database. If we disregard references to these publication on Twitter, evidence of public attention was found in Altmetric.com for 28 percent (Hav) and 33 percent (KMM) of the publications.

We consider the coverage of publications from RCN projects in Altmetric.com to be sufficient to provide robust results at the aggregate level. We still need to be cautious that singular publications or projects may have attracted public interest without this interest being captured in Altmetric.com.

³ <https://www.regjeringen.no/contentassets/9aa4570407c34d4cb3744d7acd632654/en-gb/pdfs/stm201820190004000engpdfs.pdf> (Accessed 13.4.2022)

⁴ <https://www.altmetric.com/about-our-data/our-sources-2/>

Table 1. Publication retrieval and presence in Altmetric.com

	KMM	Hav
Number of funded projects marked as relevant for LTP	1152	511
Publications from 2015 to 2021 with DOI	6540	2980
Publications identified in Dimensions	4241	1750
Publications with mentions in Altmetric	3214	1265
Publications with mentions in Altmetric except Tweets	1414	497

2.2 Analysis

A descriptive statistical analysis was performed on two coupled datasets of research projects and altmetric citations.

Dataset I: Altmetric score data coupled to RCN project numbers through DOIs present in the two data sources

Dataset II: Complete set of altmetric data coupled to complete set of RCN project data through DOIs present in the two data sources

Dataset I is a subset of Dataset II, and was used in the initial analysis because of ease of use. The initial analysis was done in Excel. The analysis of Dataset II was done using statistics software on the MS Azure platform by Kristian Sandmoen (Tieto Evry). All tables and figures were produced by Jon Holm (RCN) based on the data aggregated from Dataset I and II. Analysis were done on two levels:

Publication level: Altmetric-data was coupled directly to project-data through the DOIs of publications reported to RCN. At this level all publications inherited the properties (funding types etc) attributed to the project reporting the publication.

Project level: Altmetric-data was analysed at the level of the project by asking if a specific project had any publication that was cited in any of the mention types selected for the analysis. This means that the result was unaffected by the number of publications being cited for each mention type – and the number of citations per publication – as long as the project had at least one publication that was cited once by one of the sources in altmetric.com. In other words, we recorded the presence of attention without attempting to measure the magnitude of the attention received.

Only project level statistics were used for the annual reporting to the Ministry of Education and Research.

3 Results

In this chapter we will present statistics at various levels of aggregation: The long-term plan (LTP) priorities in question (KMM and Hav), projects and funding types. We will also show some distributions of mentions at the publication level. For some of the analysis we will use the Altmetric Attention Score as our dependent variable, which is a weighted count of the attention that a scholarly article has received across different media⁵. When appropriate we will also present statistics for individual mention sources, i.e. specific media outlets, policy documents etc. Because attention on Twitter may easily be influenced by the tweets of authors of the included scientific publications and their project team members, we have chosen to exclude these mentions from the analysis of specific mention sources. Nonetheless, tweets are included when we use the Altmetric Attention Score as our dependent variable.

Table 2. Mention types by frequency and shares (Tweets excluded)

	Number of mentions		Share of total ex. Tweets	
	KMM	Hav	KMM	Hav
Blog post	1495	250	16 %	14 %
F1000 post	19	5	0 %	0 %
Facebook post	1093	269	12 %	15 %
Google+ post	176	35	2 %	2 %
News story	4990	909	55 %	52 %
Patent	69	34	1 %	2 %
Peer review	40	24	0 %	1 %
Policy document	799	126	9 %	7 %
Reddit post	147	22	2 %	1 %
Video	33	6	0 %	0 %
Wikipedia page	214	62	2 %	4 %
Total ex. Tweets	9077	1742	Tweets as share of total	
Tweets	62877	12839	87 %	88 %
Total	71954	14581		

Twitter is by far the most frequent type of mentions in the Altmetric database. Using Twitter as a dissemination channel has a documented potential for scholars to draw wide attention to their

⁵ For more information see, <https://www.altmetric.com/blog/scoreanddonut/>

research.⁶ Because researchers may quite easily generate tweets and retweets of their own publications, we need to be cautious on how to use tweets as an indicator of public interest in research. The text of the actual tweets are not included in the Altmetric-data due to intellectual property limitations. This makes it impossible to know why a person is tweeting or retweeting a reference to a research article. The literature on research assessment includes examples of more robust analysis of Twitter data, for instance by looking at the network of followers for individual researchers.⁷ The Altmetric-database does not currently include data on networks of followers.

From the list of most frequent mention sources above we have selected the following sources as the most relevant to indicate public interest and societal impact of RCN funded research: News stories, Patents, Policy documents and Wikipedia articles. In the following chapters, we will present overall statistics showing the level of public attention associated with different funding types. For some of these variables we will also show statistics for the selected mention types.

3.1 Attention and mentions by types of funding

In this chapter we will analyse the difference in attention for the most common funding types at RCN. Funding types are determined based on the type of application (søknadstype) that is used in the call for proposals. RCN uses standardised types of application for different purposes, like basic research, strategic research and research for the benefit of business, public services or policy.

Table 3. Types of funding at RCN (application types)

Funding types⁸ <i>English name</i> Norwegian name	Objective (where available)
<i>Researcher Project</i> Forskerprosjekt	To promote renewal and development in research across all disciplines and thematic areas.
<i>Young researcher talent</i> Unge forskertalenter	To give talented young researchers under the age of 40 (2–7 years after defence of an approved doctorate) the opportunity to pursue their ideas and lead a research project
<i>Collaborative and Knowledge-building Project</i> Kompetanseprosjekt for næringslivet Kompetanseprosjekt med brukermedvirkning Kompetanse- og samarbeidsprosjekt	To promote cooperation to develop R&D expertise and capacity in areas of importance to society and business and industry.
<i>Innovation Project</i> Innovasjonsprosjekt i næringslivet Brukerstyrt innovasjonsprosjekt	To encourage value creation and renewal in the business and public sectors.

⁶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7135289/>

⁷ Nicolas Robinson-Garcia, Thed N van Leeuwen, Ismael Ràfols, [Using altmetrics for contextualised mapping of societal impact: From hits to networks](#), Science and Public Policy, Volume 45. Issue 6. December 2018. Pages 815–826. <https://doi.org/10.1093/scipol/scy024>

⁸ In recent years RCN has merged some of the application types in broader types

<i>Personal postdoctoral grant</i> Personlig postdoktorstipend	N/A
<i>Strategic institutional support</i> Institusjonsforankret strategisk prosjekt	N/A
<i>Other institutional support</i> Annen institusjonsstøtte	N/A
<i>International calls for proposals</i> Internasjonale utlysninger	N/A
<i>Other support</i> Annen støtte	N/A

3.1.1 Attention by types of funding

In the tables below we use the Altmetric Attention Score as an indicator for public attention and potential societal impact. The Altmetric Attention Score is a weighted count of the attention that a scholarly article has received across different media. The goals of the analysis is to identify any systematic differences across funding types.

Table 4. Attention score by funding types. Publications from projects classified as relevant for thematic area 'Seas and Oceans' (Hav)

Hav	# publ	% publ	Sum of Altmetric Score	Mean Altmetric Score
<i>Researcher Project</i> Forskerprosjekt	1051	60 %	11097	10.6
<i>Personal postdoctoral grant</i> Personlig postdoktorstipend	21	1 %	283	13.5
<i>Collaborative and Knowledge-building Project</i> Kompetanseprosjekt for næringslivet	455	26 %	974	2.1
<i>Innovation Project</i> Innovasjonsprosjekt i næringslivet	91	5 %	549	6.0
<i>Other</i>	131	7 %		
Total	1749	100 %	16064	9.2

Table 5. Attention score by funding types. Publications from projects classified as relevant for thematic area 'Climate, the environment and clean energy' (KMM)

KMM	# publ	% publ	Sum of Altmetric Score	Mean Altmetric Score
<i>Researcher Project</i> Forskerprosjekt	2112	50.5 %	39426	18.7
<i>Young researcher talent</i> Unge forskertalenter	28	0.7 %	1399	50.0
<i>Personal postdoctoral grant</i> Personlig postdoktorstipend	24	0.6 %	340	14.2
<i>Collaborative and Knowledge-building Projects</i>				

Kompetanseprosjekt for næringslivet	497	11.9 %	1604	3.2
Kompetanseprosjekt med brukermedvirkning	51	1.2 %	114	2.2
Kompetanse- og samarbeidsprosjekt	9	0.2 %	53	5.9
<i>Innovation Projects</i>				
Innovasjonsprosjekt i næringslivet	92	2.2 %	338	3.7
Brukerstyrt innovasjonsprosjekt	12	0.3 %	44	3.7
<i>Strategic institutional support</i> Institusjonsforankret strategisk prosjekt	28	0.7 %	216	7.7
<i>International calls for proposals</i> Internasjonale utlysninger	20	0.5 %	172	8.6
<i>Other</i> Andre	1308	31.3 %		
Total	4181		78068	18.7

Let us first comment on the differences in profile of the two thematic priorities: The Seas and the Oceans (Hav) is a smaller field than Climate, the environment and clean energy in terms of research publications (KMM). The amount of attention received by research in KMM is also twice as large as indicated by the total mean Altmetric Attention Score. As the public interest in research themes is related to the broader political and cultural agendas, it is impossible to use the level of this score as a direct indicator of the societal engagement of the projects funded by RCN. Knowing that the issues of climate and renewable energy is high on the political agenda, the difference in scores may well be an effect of a higher interest in the research theme among the general public than a difference in societal engagement and dissemination efforts in the projects.

More interestingly, there seems to be systematic differences in the attention received by projects according to types of funding (*søknadstyper*). The broad picture across the two thematic priorities is that *Reserchers projects* – which includes basic research and investigator-led thematic research – leads to more public attention than funding targeting specific users in government or businesses. Again, we need to be careful in interpreting these results as an indication of the lack of societal engagement or dissemination in the more user-oriented projects. Rather we may have reason to believe that a larger part of research dissemination taking place in user-oriented projects follows more direct channels, like knowledge co-creation and dialogue, than the formalised path recorded by altmetrics of a research publication being cited in non-academic media. Nonetheless, if it is true that results from basic research funding have a higher propensity of reaching the general public, and thereby supporting civic engagement in research, this finding may be relevant when making priorities in RCN investments.

3.1.2 Mentions by types of funding

In the tables below, we will bring more detail to the analysis of public attention to research, funded by RCN in the selected areas, by looking into four specific types of citations in non-academic documents. One publication may have more than one mention for each mention source. We have chosen News media and Wikipedia that are types of media with a broad reach targeting the general audience. For more specialised audiences we have chosen citations (which are called mentions in altmetric.com) in policy-document and patents to indicate relevance of research for public policy and business respectively.

Table 6. Mentions for selected funding types. Publications from projects classified as relevant for thematic area 'Seas and Oceans' (Hav)

Hav		News mentions		Policy mentions		Patent mentions		Wikipedia mentions	
Funding types	# publ	mean	sum	mean	sum	mean	sum	mean	sum
<i>English name</i> Norwegian name									
<i>Researcher Project</i> Forskerprosjekt	1051	0.54	563	0.09	93	0.02	19	0.05	48
<i>Postdoctoral grant</i> Personlig postdoktorstipend	21	0.57	12	0.10	2	0.00	0	0.05	1
<i>Innovation Project</i> Innovasjonsprosjekt i næringslivet	91	0.56	51	0.00	0	0.07	6	0.04	4
<i>Collaborative and Knowledge-building Projects</i>									
Kompetanseprosjekt for næringslivet	455	0.06	28	0.03	15	0.01	6	0.02	8
Kompetanseprosjekt med brukermedvirkning	6	0.00	0	0.00	0	0.33	2	0.00	0
Overall score*	1749	0.52	909	0.07	125	0.02	34	0.04	62

*) Includes all funding types, not only those included in the table

Table 7. Mentions for selected funding types: Publications from projects classified as relevant for thematic area 'Climate, the environment and clean energy' (KMM)

KMM		News mentions		Policy mentions		Patent mentions		Wikipedia mentions	
Funding types	# publ	mean	sum	mean	sum	mean	sum	mean	sum
<i>Researcher Project</i> Forskerprosjekt	2112	1.14	2412	0.18	381	0.01	27	0.05	114
<i>Young researcher talent</i> Unge forskertalenter	28	3.89	109	0.14	4	0.04	1	0.11	3
<i>Postdoctoral grant</i> Personlig postdoktorstipend	24	0.54	13	0.17	4	0.00	0	0.13	3

<i>Innovation Project</i> Innovasjonsprosjekt i næringslivet	92	0.15	14	0.08	7	0.01	1	0.00	0
<i>Collaborative and Knowledge-building Projects</i>									
Kompetanseprosjekt for næringslivet	497	0.12	61	0.11	55	0.02	9	0.01	5
Kompetanseprosjekt med brukermedvirkning	51	0.00	0	0.04	2	0.08	4	0.00	0
Overall scores*	4181	1.18	4943	0.19	790	0.02	68	0.05	210

*) Includes all funding types, not only those included in the table

The detailed analysis of attention received by research publications in News media, Policy documents, Patents and Wikipedia shows some of the same pattern as the overall attention score: *Researcher projects* seem to attract more attention per publication than the other funding types, except for patent citations. Still, in the area Oceans and seas (Hav), *Innovation projects* show a mean number of News mentions on par with *Researcher projects* (0.56 vs 0.54). We looked into the data to understand better this deviance from the general pattern. The publications in the *Innovation projects* dataset were produced by five distinct RCN-projects, among which one project (p.nr. 256466) sticks out as the unusual apple in the *Innovation projects* basket. The project "Extreme Wave Warning Criteria for Marine Structures" has attracted 41 of 58 citations in its category. It is led by the Norwegian certification company DNV GL, who is a highly research oriented company⁹. This specific project contributed to a multi-authored paper in *Nature Climate Change* (2019): Robustness and uncertainties in global multivariate wind-wave climate projections (DOI10.1038/s41558-019-0542-5). The finding that "Climate change is making ocean waves more powerful, threatening to erode many coastlines" made headlines in 20 international news outlets.¹⁰

As we could expect, the funding types *Innovation projects* and *Collaborative and Knowledge-building Project* have relatively high mean scores for patent citations. Still, the patent citations are rare across the board, with only 2 percent of the publications being cited in patents. What might be less in line with expectations linked to funding types, is that funding for basic research also seems to have the highest propensity to be cited in policy documents. The total number of policy mentions is quite moderate for projects in 'Seas and Oceans' with only 7 percent of the publications being cited by a policy document, whereas projects in 'Climate, the environment and clean energy' has a near 20 percent chance of being cited in a policy document. These figures are calculated based on policy sources internationally. An overview of the Norwegian policy sources is found in the Appendices.

3.2 Publication level statistics

In this chapter we will present a set of publication level statistics. In the reporting to the Ministry of Education and Research, RCN used publication level statistics to look for examples of documented societal impact. Taking publications with high attention as a starting point, the case officer would

⁹ <https://www.dnv.com/research/index.html>

¹⁰ <https://www.altmetric.com/details/65165682/news>

look for additional information in reporting from the relevant projects and other sources. The tables below show the 10 most cited publications from the KMM and Hav portfolios.

Table 8. 10 most cited publications from the KMM portfolio

744

Project #	Journal	Year	Title	Altmetric Score
235638	Science	2016	The Anthropocene is functionally and stratigraphically distinct from the Holocene	1975
287402	Nature Sustainability	2019	China and India lead in greening of the world through land-use management	1859
209701	Science	2016	The trouble with negative emissions	1648
296205	Procedia Technology - Elsevier	2020	The global scale, distribution and growth of aviation: Implications for climate change	1534
209701	Earth System Science Data	2018	Global Carbon Budget 2018	1515
209701	Nature Climate Change	2019	Drivers of declining CO2 emissions in 18 developed economies	1465
235548	Nature Geoscience	2017	Emission budgets and pathways consistent with limiting warming to 1.5 °C	1407
209701	Nature Climate Change	2015	Reaching peak emissions	1232
192141	Science	2021	Hemispheric asymmetry in ocean change and the productivity of ecosystem sentinels	1173
300718	Atmospheric Environment	2020	The contribution of global aviation to anthropogenic climate forcing for 2000 to	1109

Table 9. 10 most cited publications from the Hav portfolio

Project #	Journal	Year	Title	Altmetric Score
192141	Science	2021	Hemispheric asymmetry in ocean change and the productivity of ecosystem sentinels	1173
192141	Nature Climate Change	2018	Global phenological insensitivity to shifting ocean temperatures among seabirds	872
244319	Communications Biology	2020	Artificial light during the polar night disrupts Arctic fish and zooplankton behaviour down to 200 m depth	352
244319	Current Biology	2016	Moonlight Drives Ocean-Scale Mass Vertical Migration of Zooplankton during the Arctic Winter	350
257584	Marine Pollution Bulletin	2019	Global ecological, social and economic impacts of marine plastic	287
256466	Nature Climate Change	2019	Robustness and uncertainties in global multivariate wind-wave climate projections	248
254850	Nature Sustainability	2019	Towards a sustainable and equitable blue economy	243
267820	Journal of Physiology	2019	Polyaromatic hydrocarbons in pollution: a heart-breaking matter	236
276730	Journal of Climate	2018	Seasonal and Regional Manifestation of Arctic Sea Ice Loss	236
203850	Proceedings of the National Academy of Sciences of the United States of America	2017	Ancient DNA reveals the Arctic origin of Viking Age cod from Haithabu, Germany	232
276730	Science Advances	2020	Increasing riverine heat influx triggers Arctic sea ice decline and oceanic and atmospheric warming	182
281040	Aquaculture Economics & Management	2019	Innovation in seafood value chains: the case of Norway	180

Although the KMM portfolio boasts the publications with highest attention score, the top 10 most cited publications from both portfolios are among the top 5 percent of all research outputs scored by Altmetric.

Not all research publications are expected to receive public attention. The distribution of Attention scores among both publications and projects shows the same skewed distribution that is typical of scientific citations¹¹. The plots below show the skewedness of Altmetric Scores for publications from projects classified as belonging to the KMM and Hav portfolios. For KMM the 10 percent most cited projects received 73 percent of the attention measured by the sum of Attention Scores. For Hav the equivalent ratio is 48 percent of the attention received by the 10 percent most cited publications.

Table 10. Plot of Altmetric Attention score for KMM publications

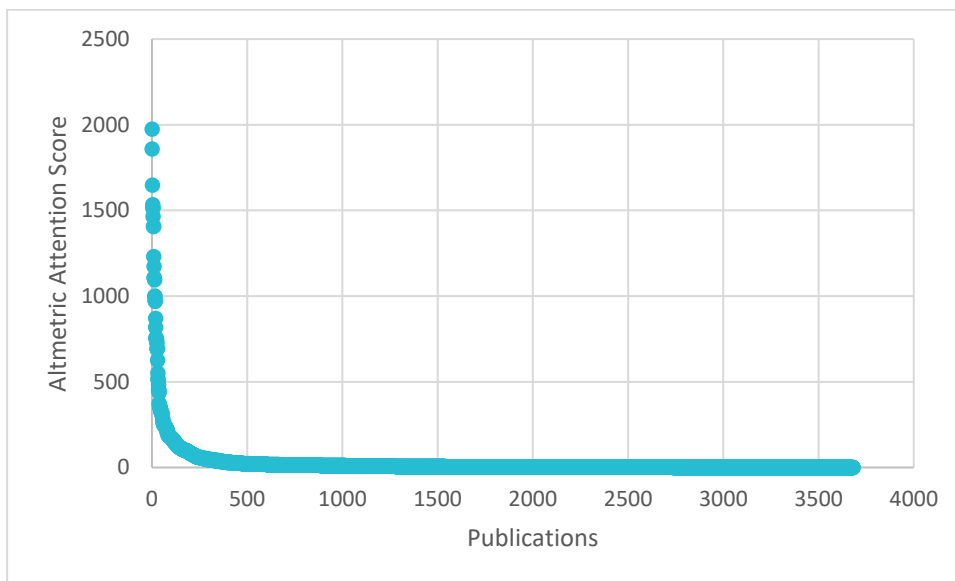
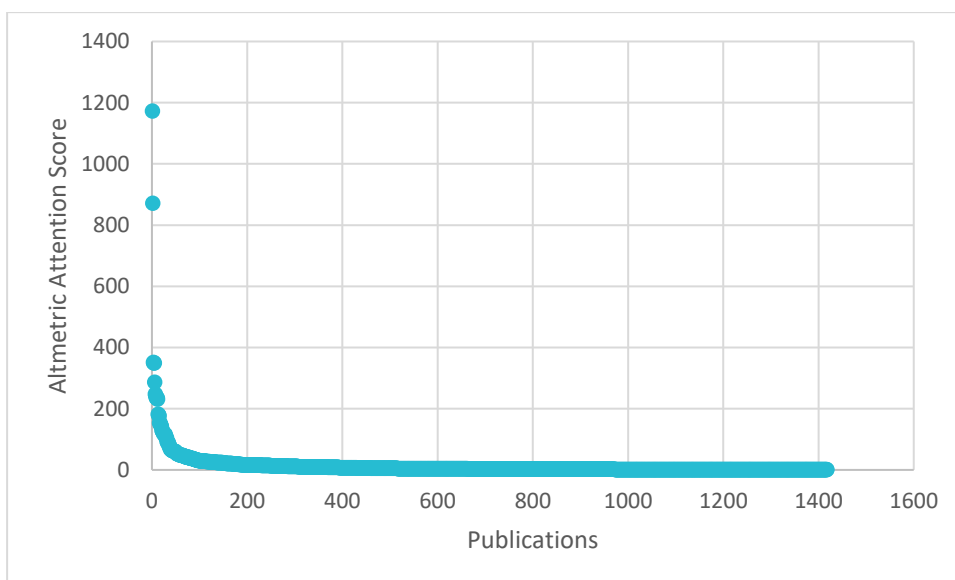


Table 11. Plot of Altmetric Attention score for Hav publications



¹¹ See i.a. Seglen, P. O. (1992). The skewness of science. *Journal of the American society for information science*, 43(9), 628-638. [https://asistdl.onlinelibrary.wiley.com/doi/10.1002/\(SICI\)1097-4571\(199210\)43:9%3C628::AID-ASI5%3E3.0.CO;2-0](https://asistdl.onlinelibrary.wiley.com/doi/10.1002/(SICI)1097-4571(199210)43:9%3C628::AID-ASI5%3E3.0.CO;2-0)

3.3 Project level statistics

When aggregating the publications up to the project level by calculating the sum of attention scores for publications reported to RCN from each project, the figures below show a less skewed picture than for the publication level.

Table 12. Plot of Altmetric Attention score for KMM projects

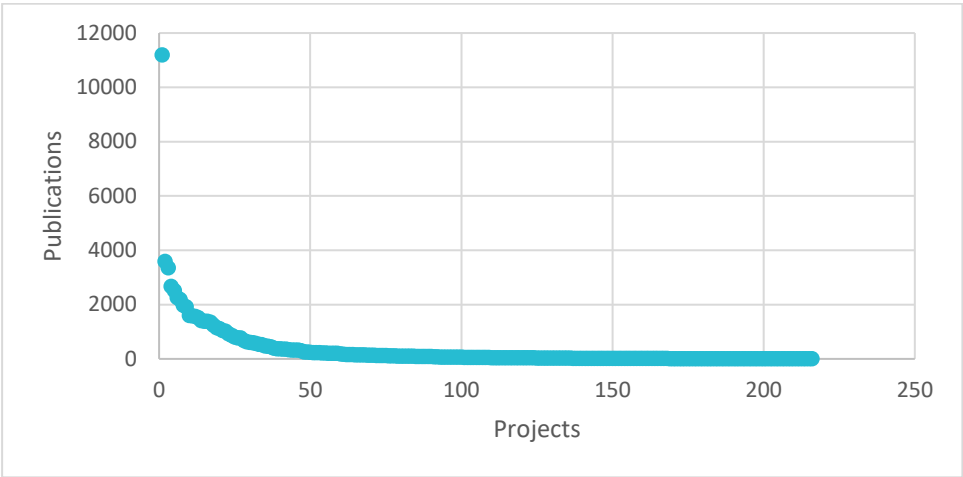
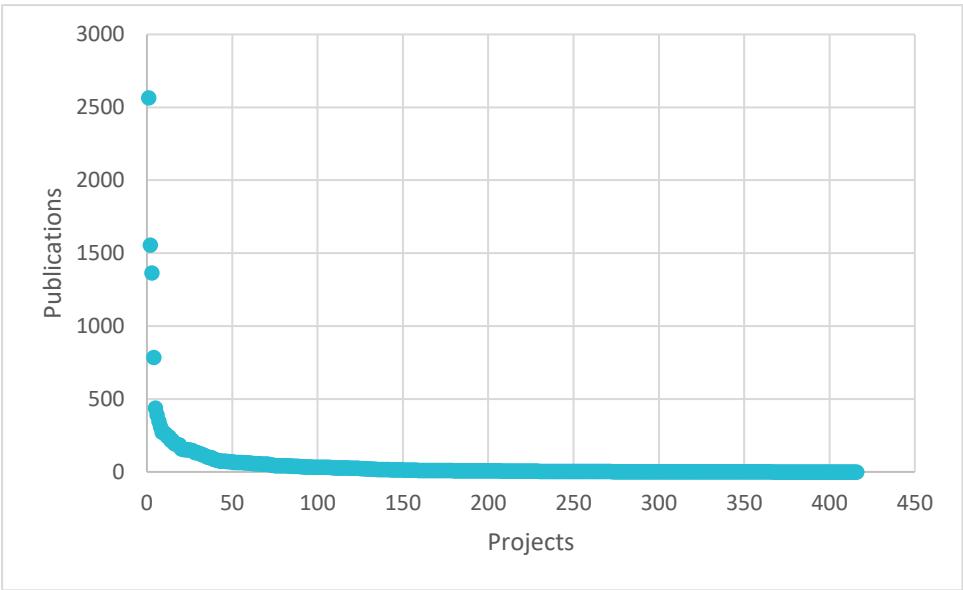


Table 13. Plot of Altmetric Attention score for Hav projects



RCN-funding decisions are based on the properties of the proposed projects for research. Thus, in the reporting to the Ministry of Education and Research it was judged appropriate to use Altmetric-data aggregated up to the project level. We also chose to focus on a set of relevant mention types: News stories, Patents, Policy documents and Wikipedia articles. Twitter is also included as the most frequent Altmetric mention source.

In line with our expectations, we did not find publications with mentions of the specified types for all projects. Public attention and societal impact may follow various paths and there may be a substantial time lag from research is published until it finds some resonance in the wider society. The data used in this analysis provides a snapshot of the attention documented through a limited set of data sources as of December 2021. Nonetheless, the tables below show that a substantial number of

projects has received public attention that indicate that they are contributing or may contribute to solve the societal challenges identified by the governments Long-Term plan for research and higher education.

Table 14. Mention type frequency and share for KMM portfolio

Total projects	Policy	Patents	News	Wikipedia	Twitter	only Twitter	none
866	216	36	240	75	739	410	81
Percent by types of mention	25 %	4 %	28 %	9 %	85 %	47 %	9 %
Excl. RCN-mentions	198						
Percent excl. RCN-mentions	23 %						

Table 15. Mention type frequency and share for Hav portfolio

Total projects	Policy	Patents	News	Wikipedia	Twitter	only Twitter	none
416	69	22	107	35	343	247	50
Percent by types of mention	17 %	5 %	26 %	8 %	82 %	59 %	12 %
Excl. RCN-mentions	47						
Percent excl. RCN-mentions	11 %						

Twitter appears as the dominant channel for research dissemination with mentions of research publications documented for over 80 percent of the projects in both portfolios. Among the other selected mentions types, the most frequent attention is documented in news outlets followed by policy documents and Wikipedia. Patent citations are relatively rare in both portfolios with relevance only for 5 percent or below of the projects. The share of projects with mentions is relatively similar between the two portfolios except for policy-mentions where the share of KMM-projects with policy-mentions (23 %) is twice as high as for Hav-projects (11 %), when references to RCN-documents are disregarded.

In the figures used in the yearly reporting, RCN has chosen to exclude the documents published by itself from the policy sources, indicated as 'percent excl. RCN-mentions' in the tables above. The majority of the references in these publications emanate from the yearly reporting to RCN from independent research institutes where they are invited to list their five most important publications or the year. The importance of these publications is assessed by the research institutes themselves. RCN has not made any independent judgement on the policy-relevance of these publications prior to the publications of the yearly reports. Details on geographic distribution and Norwegian sources of policy documents and news outlets are provided in the Appendices.

4 Discussion

The present study was designed as a pilot to test the usefulness of Altmetric-data in the context of the annual reporting of RCN to the Ministry of education and research. We may thus divide the discussion of the results in two:

Question A: What can altmetrics tell us about a specific funding portfolio at RCN?

Question B: What may be the role of altmetrics in documenting the societal impact of RCN-funding?

4.1 What did we learn about the funding portfolio at RCN?

Data on citations of research publications in non-academic media, policy-documents, patents and on Wikipedia may provide a new and unique perspective on the (potential) societal impact of RCN funded projects. This said, like with all data sources and methods it is important to be aware of its limitations. We can think of especially three important limitations in using altmetric data as an indicator for societal impact:

1) Data from altmetric.com is limited to dissemination of knowledge in the formalised form of a research publication, and the documentation of the reception of that publication in the form of a citation. Projects may have substantial societal impact through other means of communication than research publications and subsequent citations. Various societal actors may also be influenced by reading research publications without citing these in any subsequent publications.

2) The citations collected by altmetric.com is limited in terms of the sources that are web-scraped by the service. There are clear geographical and linguistic biases in the selection of sources. In our study we still found that the coverage of Norwegian media was quite good, with the public broadcasting company (NRK) and a selection of national newspapers being included among the sources. On the other side, policy-sources were less well covered, and even included annual reports collected by RCN from independent research institutes. As these reports are not a part of any specific policy-process, references therein cannot be said to document the use of research publications as evidence for policy.

3) The third limitation is the more fundamental question of what it means to be cited. Both academic and non-academic actors can refer to a research publication for a number of reasons. The problem of interpreting citations is treated extensively in the literature on academic citations¹². It is less well studied when it comes to citations in non-academic media. On an aggregate level it is still reason to believe that a high level of citation is most often a signal of positive interest.

One virtue of the altmetric.com database is the complete transparency in the selection of data sources and the access to the actual citations, except for Twitter. Our assessment is that altmetrics.com may be a useful and cost-effective source of information on the societal impact of RCN-funding if it is used in combinations with other data-sources.

¹² Aksens et al. (2019) [Citations, Citation Indicators, and Research Quality: An Overview of Basic Concepts and Theories](#), SAGE Open January-March 2019: 1–17

4.2 The role of altmetrics in documenting the societal impact of RCN-funding

Taking into account the limitations of altmetric data as an indicator for societal impact, we could still see a number of potential uses for altmetric.com. Like with other metrics, the most important rule of caution is not to use altmetric.com as a single source of knowledge. Altmetric data may still be a useful supplement to the knowledge base used for managing the project portfolio at RCN. Here we will highlight four ways to use altmetric-data responsibly:

1) **Scouting**

Data on attention could help lead the attention of case officers to publications or projects that have a potential for societal impact. Inversely, if there are now traces of attention found for a set of projects where case officers would expect this to be the case, this could lead to various follow-up activities aiming at checking if a project is progressing as expected.

2) **What does good (and bad) look like?**

When interpreting the analysis of altmetric-data for this study, we often had recourse to the knowledge of the relevant case officers to calibrate our expectation. Unlike for standard bibliometric indicators, there are no normalised citation indexes for altmetrics. To handle this lack of standardised measure, we ended up using simple dichotomous indicators, like whether any publication from a project had received a specific type of attention or not. The working hypothesis was that some attention is good, whereas a project with no attention documented in altmetric.com would be less likely to have a large societal effect than a project with documented attention.

3) **Skewedness of data**

Our analysis show that level of altmetric-citations is extremely skewed in each of the publications sets. Ten percent of the publications accounted for between half (Hav) and three quarters (KMM) of the citations. This means that it is not advisable to use altmetric-citations as an indicator for small datasets or early in a project's life span. We should be open for the possibility that projects may still not have published their most impactful publications and that the public interest in these publications may change in the future (think Covid19). We have dealt with this problem by aggregating measures of attention to the project level, and by using dichotomous indicators as described in paragraphe 2 above.

4) **Linking attention to impact through logic models**

Finally, we see a great potential for making good use of altmetric data by linking the interpretation of altmetric data to the logic models used in the portfolio plans that govern RCN's investments in research. Simply put, a logic model is a planning tool that is used to outline the expected chain of effects from the funding decision through the activities of the projects and onto its outputs, outcomes and impacts. While the research publications are the stereotypical output of a research project, the attention documented by altmetric.com may be seen as indicating an outcome. Planned outcomes of research projects at RCN, often describe the interaction of projects with its non-academic surroundings through formalised cooperation or more dissemination oriented activities. The societal impact is the final stage of this chain of effect, and that is what the Ministries asked RCN for the annual report: What do we know about the societal impact of RCN-funding?

In its most developed form, the logic model is based on a theory of change that indicates how a policy instrument could be designed to achieve the societal goal in the most efficient and effective way. The logic model for a funding portfolio at RCN will typically indicate a set of actors that need to be involved and/or influenced by the funded research activities. Altmetric data could be used to look for traces of attention from non-academic actors indicated by in the portfolio plans.

5 Conclusion

RCN has gained new knowledge about its funding portfolio through the use of data from altmetric.com. The findings here reported were discussed and interpreted with case officers from the relevant research to prepare a specific section on the societal impact of RCN funding in the annual report to the Ministry for education and research. Only project levels statistics were retained for the annual report. Other types of results, like lists of publications and projects with high Altmetric Attention Scores were used to guide attention to projects case officers could search for other evidence of societal impact in project reports et cetera.

Besides findings used in the annual report, the analysis shows that public attention received by a set of publications reported from a project vary according to the funding type and the specific research theme of the project. Because trends in public opinion and interest are largely outside of the control of the specific project, it is difficult to attribute variation in the level of attention across themes to properties of the projects. It is probably more relevant to pay attention to how attention scores vary across funding types within each theme. Information on the expected attention for a set of funding types across news media, policy and patents, may be valuable information for a portfolio board when deciding on the mix of funding types (applications types) to use in future calls for proposals.

Future use of altmetric data could include analysis of correlations between project properties and project outcomes in terms of different types of attention as attested by altmetric citations, a more in depth analysis of the citing sources aiming at understanding the sense of the citation (sentiment analysis) and classification of citing sources according to research policy goals. In most cases, Altmetric.com includes a documentation of the context of citation that may be used both for sentiment analysis and for classifications using Natural Language Processing techniques. Unfortunately, the texts of citations on Twitter is not included in the database due to Intellectual Property restrictions.

Data coverage remains an issue. While altmetric.com had a coverage of between 59 and 69 of the reported publications from the KMM and Hav portfolios, we expect coverage to be more limited for research themes that have a higher share of research from the social sciences and humanities. Future analysis of the societal impact of RCN-funding include two research priorities from the Long-Term Plan with a high share of research from the social sciences and humanities, namely "Public sector renewal and better public services" and " Societal security and social cohesion in a globalised world". To document the societal impact of RCN-funding within such thematic priorities, it is important to use data sources that include citations to a broader set of academic outlets, like books and edited volumes.

6 Appendices

6.1 Abbreviations

LTP	Long-term plan for research and higher education in Norway
MRS	System for the management by aims and results used by the Ministry of education and research to manage RCN
KMM	Climate, the environment and clean energy (research priority)
Hav	Seas and oceans (research priority)
RCN	Research Council of Norway

6.2 Data sources for KMM

6.2.1 News outlets KMM

Table A1. Geographic distribution of news sources for KMM

Note: Each distinct news outlet is counted as a 'profile'

Country code	Country name	Number of posts	Number of profiles
US	United States	2143	433
GB	United Kingdom	823	156
AU	Australia	286	31
IN	India	235	60
DE	Germany	223	40
NO	Norway	131	12
ES	Spain	106	38
DK	Denmark	104	6
NZ	New Zealand	103	11
CA	Canada	101	37
FR	France	76	26
CH	Switzerland	63	16
SG	Singapore	62	8
IT	Italy	59	19
RU	Russia	55	14
SE	Sweden	40	11
AT	Austria	33	7
JP	Japan	31	7
CN	China	27	14
NL	Netherlands	23	14
BE	Belgium	20	8
FI	Finland	19	6
BR	Brazil	19	11
	Unknown	15	2
ZA	South Africa	12	6

BD	Bangladesh	12	8
PT	Portugal	12	4
HU	Hungary	11	5
CL	Chile	11	3
	Other	135	75

Table A2. Details on Norwegian news outlets sources for KMM

Mention source	Country	Number of mentions
forskning.no	Norway	58
NRK	Norway	23
Aftenposten	Norway	21
ABC Nyheter	Norway	9
Dagens Næringsliv	Norway	8
Dagbladet	Norway	3
Aftenbladet	Norway	3
E24	Norway	2
Svalbardposten	Norway	1
Nationen	Norway	1
Gemini.no	Norway	1
Dagsavisen	Norway	1

6.2.2 Policy documents KMM

Table A3. Geographic distribution of policy documents for KMM

Note: Each distinct news outlet is counted as a 'profile'

Country code	Country name	Number of posts	Number of profiles
NO	Norway	181	2
CH	Switzerland	108	5
IT	Italy	98	1
US	United States	79	9
LU	Luxembourg	68	1
AU	Australia	63	1
SE	Sweden	63	3
GB	United Kingdom	46	6
NL	Netherlands	23	3
FR	France	17	2
KE	Kenya	16	1

CA	Canada	10	4
BE	Belgium	9	2
AE	United Arab Emirates	6	1
IN	India	5	1
IE	Ireland	3	1
PA	Panama	1	1
MA	Morocco	1	1
FI	Finland	1	1
DE	Germany	1	1

Table A4. Details on Norwegian policy sources for KMM

Mention source	Country	Number of mentions
The Research Council of Norway	Norway	160
The Norwegian Government	Norway	21

Table A5. Documents registered in Altmetric with 'The Norwegian Government' as source

Mention Date	Mention Title
02.05.2020	360 graders analyse av potensialet for nullutslippskjøretøy
22.06.2017	Fagsystem for fastsetting av god økologisk tilstand
14.02.2020	Husdyrgjødsel til biogass
08.06.2021	Høring - Europakommisjonens forslag til ny CO2-grensetilpasningsmekanisme (CBAM)
30.06.2017	Kartlegging av gjeldende planpraksis etter plan- og bygningsloven i sjøområdene
17.04.2020	Meld. St. 14 (2019–2020)
20.01.2021	Meld. St. 33 (2019–2020)
07.12.2018	NOU 2018: 17
27.11.2019	NOU 2019: 21
08.04.2021	Offentlig høring av Kommisjonens forslag til tre forsterkede regelverk (ETS, innsatsfordelingsforordningen og skog- og arealbruksregelverket)
07.02.2020	Rapport fra Teknisk beregningsutvalg for klima 2020
06.01.2016	Rovviltbestandens betydning for landbruk og matproduksjon basert på norske ressurser
10.01.2020	Utredning av erfaringer med å sikre god arkitektur i planlegging

6.3 Data sources for Hav

6.3.1 News outlets Hav

Table A6. Geographic distribution of news sources for KMM

Note: Each distinct news outlet is counted as a 'profile'

Country code	Country name	Number of posts	Number of profiles
US	United States	380	188
GB	United Kingdom	182	87
AU	Australia	62	14
NO	Norway	49	7
IN	India	37	28
DE	Germany	34	12
NZ	New Zealand	22	2
ES	Spain	19	10
CH	Switzerland	16	8
CA	Canada	14	11
DK	Denmark	11	2
	Other	83	29

Table A7. Details on Norwegian news outlets sources for Hav

Mention source	Country	Number of mentions
forskning.no	Norway	24
NRK	Norway	11
Aftenposten	Norway	6
Dagens Næringsliv	Norway	5
Gemini.no	Norway	1
E24	Norway	1
ABC Nyheter	Norway	1

6.3.2 Policy documents Hav

Table A8. Geographic distribution of policy documents for Hav

Note: Each distinct news outlet is counted as a 'profile'

Country code	Country name	Number of posts	Number of profiles
NO	Norway	54	2
LU	Luxembourg	12	1
GB	United Kingdom	11	4
CH	Switzerland	11	3
IT	Italy	11	1
SE	Sweden	5	1
US	United States	5	1
AU	Australia	4	1
FR	France	4	1
KE	Kenya	3	1
IE	Ireland	2	1
NL	Netherlands	2	1
CA	Canada	1	1
DE	Germany	1	1

Table A9. Details on Norwegian policy sources for Hav

Mention source	Country	Number of mentions
The Research Council of Norway	Norway	53
The Norwegian Government	Norway	1

Note: RCN has chosen to exclude the documents published by itself from the policy sources. The majority of the references in these publications emanate from the yearly reporting to RCN from independent research institutes where they are invited to list their five most important publications or the year. The importance of these publications is assessed by the research institutes themselves. RCN has not made any independent judgement on the policy-relevance of these publications prior to the publications of the yearly reports.

Table A10. Documents registered in Altmetric with 'The Norwegian Government' as source

Mention Date	Outlet or Author	Mention Title
30.06.2017	The Norwegian Government	Kartlegging av gjeldende planpraksis etter plan- og bygningsloven i sjøområdene (NOFIMA, Rapport 15/2017)