

Stacy Konkiel, Digital Science, USA (s.konkiel@digital-science.com)
Mike Taylor, Digital Science, USA (m.taylor@digital-science.com)

Overview

Over the years, knowledge mobilization has been measured via patent filings and non-patent citation analysis, and more recently through analysis of citations to research in government and NGO-issued public policy documents. From this basis, we examine recent knowledge mobilization patterns for research published in Denmark, Finland, Iceland, Norway and Sweden from 2015-2017. We identify national trends in research productivity and collaboration using publication data from Dimensions, and compare these trends to non-patent and public policy citations to research, as well as patent filings. We offer a comparative analysis to identify areas of opportunity for growth in national research policy and planning.

Methods

We first identified research outputs published between 2015 and 2017 by authors hailing from Denmark, Finland, Iceland, Norway and Sweden using Dimensions (a linked research information system) (N = 304,471). We used this data to understand national productivity (using publication frequencies as a proxy) and collaboration patterns (using publication co-authorships).

We then used Altmetric Explorer for Institutions (an altmetrics aggregator) to analyze two kinds of non-traditional impacts for Nordic research: innovation (using patent categories and citations to research from patents as proxies) and knowledge mobilization (using citations to research from public policy documents and patents). We supplemented our innovation data with national patent filings data sourced from Dimensions, and compared national trends.

Knowledge mobilization: Patent and policy citations

By analyzing citations to research from public policy documents and patents, we can begin to understand the extent to which industry and policymakers are putting research into practice.

Here, we first examine the overall proportion of research with online attention (captured by Altmetric). Online attention is often a precursor to policy citations. Next, we calculate the proportion of online attention that comes from patent and policy citations. Attention rates in these sources for all countries is well below the worldwide average.

	2015-2017 publications with online attention	Attention for 2015 publications, in patents	Attention for 2015 publications, in public policy
Finland	42.5%	0.31%	0.27%
Iceland	46.3%	0.43%	0.08%
Denmark	48.2%	0.39%	0.32%
Norway	43.3%	0.21%	0.41%
Sweden	48.3%	0.40%	0.32%
Worldwide	-	1.96%	2.07%

Knowledge mobilization: Top patent categories, by country

Subjects for patents are assigned in Dimensions using machine learning techniques. By analyzing subject areas, we can begin to understand the industries where national research is having an impact.

Norway	Denmark	Sweden	Finland	Iceland
0915 Interdisciplinary Engineering	0906 Electrical and Electronic Engineering	1005 Communications Technologies	1005 Communications Technologies	0903 Biomedical Engineering
0903 Biomedical Engineering	0601 Biochemistry and Cell Biology	0906 Electrical and Electronic Engineering	0801 Artificial Intelligence and Image Processing	0912 Materials Engineering
0912 Materials Engineering	0915 Interdisciplinary Engineering	0801 Artificial Intelligence and Image Processing	0806 Information Systems	1103 Clinical Sciences
0906 Electrical and Electronic Engineering	0903 Biomedical Engineering	0903 Biomedical Engineering	0912 Materials Engineering	0801 Artificial Intelligence and Image Processing
0801 Artificial Intelligence and Image Processing	0912 Materials Engineering	0806 Information Systems	0906 Electrical and Electronic Engineering	0306 Physical Chemistry (incl. Structural)

Traditional benchmarking: Productivity

High-level understanding of researcher productivity is typically achieved by determining the average number of publications per researcher.

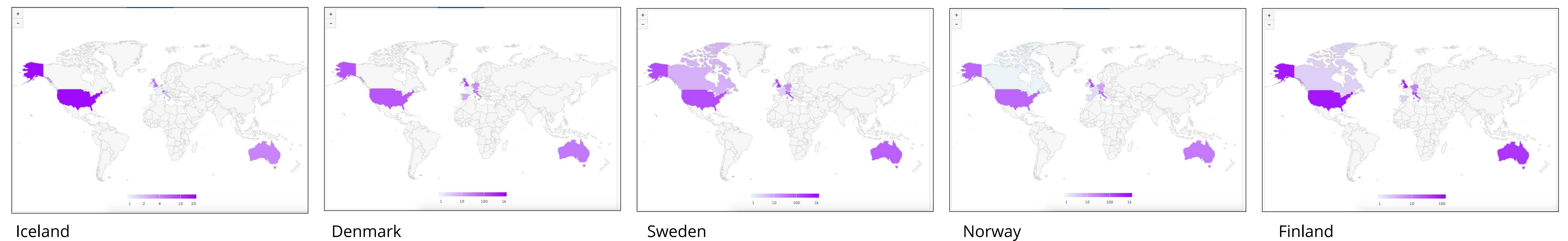
	Number of publications	Number of researchers in R&D (2015) ¹	Publications per researcher
Finland	59,579	6,816	8.7
Iceland	4,852	5,902	0.8
Denmark	81,064	7,483	10.8
Norway	66,580	5,915	11.3
Sweden	120,085	7,021	17.1
All Nordic countries	332,160*	33,137	10.0

Traditional benchmarking: Innovation

Similarly, national patent analysis often looks at over patent volume and average number of patents per researcher to understand research's effect upon industry.

	Patents granted to researchers, 2015-2017	Patents per researcher
Finland	12,333	1.81
Iceland	370	0.06
Denmark	9,469	1.26
Norway	6,052	1.02
Sweden	24,794	3.53

Knowledge mobilization: International policy impacts



Mapping policy citations offer another view on the international influence of national research in public policy. These images are sourced from Altmetric Explorer. Altmetric currently tracks 81 policy centers from 20 countries.

Traditional benchmarking: Collaboration

	# of publications where research_org_countries > 1	% where research_org_countries > 1
Finland	35,935	60.3%
Iceland	3,685	75.9%
Denmark	48,732	60.1%
Norway	42,115	63.2%
Sweden	73,925	61.6%

Limitations

- Lower than expected impact for Nordic research in policy and patents may be explained by the fact that Altmetric tracks just one regional policymaker, and no regional patent jurisdictions (except for the EU, which would cover % Nordic countries)
- This study does not take into account disciplinary differences in collaboration rates; more research is needed.

Key Takeaways

- In general, Nordic research has a lower than average impact in public policy and patents worldwide.
- Within Nordic countries, most patents are granted in the areas of engineering and biotechnology; however, Swedish and Finnish researchers buck this trend by filing patents related to telecommunications
- Iceland is far more collaborative than other Nordic nations in terms of share of internationally co-authored publications
- Nordic countries wishing to match Sweden's innovation trends (in terms of number of patents granted to researchers) may wish to explore increased training and support
- When used alongside traditional measures, altmetrics may supplement our understanding of national knowledge mobilization trends. Further study is needed to determine the extent to which this is possible outside of the Nordic region.

* Publications with multiple authors may be counted more than once towards each country's total.

¹ Researchers in R&D (per million people) - 2015, United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics. Available at <https://data.worldbank.org/indicator/SP.POP.SCIE.RD.P67end=2015&locations=SE-IS-FI-DK-NO&start=2015>