

RESEARCH STRENGTHS ANALYSIS OF AURORA

THOMAS GURNEY, PHD
CONTENT & ANALYTICS PRODUCT MANAGER, ELSEVIER
21 OCTOBER 2016

The launch of Aurora as a new university network brings together nine¹ founding partners from across Europe; all of whom are high-quality, research intensive universities.

With a strong desire to understand where we deliver excellence in research and to seek out opportunities where we can support each other to improve, Aurora commissioned Elsevier to report on the pre-existing research strengths and collaborations of network members.

This Elsevier report contains key data and insights that show our members' individual and collective research output, quality, and how extensive our organic or pre-existing collaborations are. In addition, we have chosen to benchmark ourselves against other comparative university networks to understand our strengths and opportunities as a network in the future.

We hope you find this report enlightening and of value. In the following pages there is a brief summary of the data as well as numerous insights and commentary. These are referenced to the page numbers where you'll find the related charts and tables.

We look forward to revisiting this research in the future to understand how coming together as a network has helped each of our universities to develop.

¹ The nine founding institutions are: Vrije Universiteit Amsterdam (Netherlands), Université Grenoble-Alpes (France), University of Aberdeen (Scotland), University of Antwerp (Belgium), University of Bergen (Norway), University of Duisburg-Essen (Germany), University of East Anglia (England), University of Gothenburg (Sweden) and the University of Iceland.

Page 8: All comparator networks have close to five times more publications per year than Aurora. This is primarily due to larger membership lists with each comparator network having more than double the number of members as Aurora's 9: LERU – 21 members, Coimbra – 39 members, UNICA – 44 members, Universitas 21 – 25 members. Both Universitas 21 and Coimbra have over 570,000 publications between 2011 and 2015, UNICA has just under 500,000 publications, and LERU just over 530,000 publications - compared to Aurora's 111,140 for the same period. In growth terms, expressed as Compound Annual Growth Rate (CAGR), Aurora is growing faster, at 3.89%, than each of the other comparator networks, and far faster than the total world output for the same period, at 0.47%.

Note: the term 'publication' used throughout this report refers to articles, reviews and conference papers. Please see appendix for more detailed explanation of document types and counting methods employed in this report.

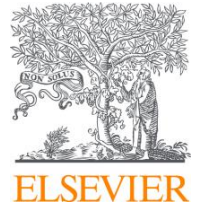
Page 9: In terms of field-weighted citation impact (FWCI), Aurora leads the comparator group with an FWCI of 1.769, or 76.9% higher than the world average, for the 2011-2015 period. Aurora output has consistently high FWCI for each year: 75+% higher than world average for each year in the period, and this figure has increased for each year in the period. Given the underlying motivation of the formation of the network, the FWCI figures of each member for each year and overall reinforce the quality of the network as a whole.

Note: FWCI: Field-weighted citation impact indicates how the number of citations received by an entity's publications compares to the average number of citations received by all other similar publications. In doing so, it accounts for differences in citation rates between subject fields, document types and publication year. As a benchmark, the FWCI of the "world", or the entire Scopus database, is 1.00. FWCI is often used as a proxy of quality. Please see appendix for more detailed explanation of FWCI.

Notes and observations to accompany charts



- Page 10: Aurora was created with the goal of uniting research efforts between universities of all sizes and research specialties. This becomes more apparent when looking at the publication output counts for each of the members. Vrije Universiteit Amsterdam (VU) and Universite Grenoble Alpes contribute the highest number of publications to the network's total, with other members' totals evenly distributed across the range.
- Page 12: All members' FWCI are above world average, with the University of Iceland having the highest FWCI across the whole period. Whilst the University of Iceland may not be the largest contributor to the network in terms of volume, it does boost the network's FWCI figures.
- Page 13: Each member of the network has maintained consistently high FWCI across the years and whole period.
- Page 14: The subject area Medicine has the highest output for all members except Universite Grenoble-Alpes, which has its highest output in Physics & Astronomy.
Note: Subject areas are derived from All Subject Journal Classifications (ASJC). Please see appendix for more detailed explanation of ASJC.
- Page 15: In removing the highlighting of the highest output subject area for each member, we see from the subject share percentages that some members are diverse, whilst others specialise. Through these differences in generalisation/specialisation, each member can potentially draw on other members' specialisations to address any shortcomings or further improve their own output volume and quality.



Notes and observations to accompany charts



- Page 16: Each member has their own strengths and areas for improvement. By identifying these areas, each member that wants to improve can collaborate with another established member, ultimately increasing the quality of research in different areas for all members. For almost all subject areas in which a member would like to improve their FWCI, there are members who are capable of providing high quality partnerships.
- Page 17: The subject area 'Multidisciplinary' FWCI is the highest of all the subject areas for all networks. The second highest FWCI subject areas vary greatly across the networks. Each network's highest FWCI subject areas are shown below:
Aurora – Earth and Planetary Sciences
Coimbra – Engineering
LERU – Business, Management and Accounting
UNICA – Nursing
Universitas 21 - Business, Management and Accounting
- Page 18: Across all comparator networks, Aurora has the highest FWCI for 13 of the 27 subject areas, equal to LERU's count of top subject areas. In many subject areas where Aurora does not have the highest FWCI, it has second highest.
- Page 19: Collaboration between members has occurred organically over the period. The greatest number of collaborative publications between members is between the University of Bergen and Universite Grenoble Alpes, followed by the University of Gothenburg and University of Bergen. VU and the University of Bergen are the most collaborative members with other universities in the network, whilst University Duisburg-Essen and University of East Anglia collaborate the least with other members of the network. They are also the only members of the network not to collaborate with all other members. Coincidentally, the only members they do not collaborate with are each other.

Notes and observations to accompany charts



- Page 20: As most members of the network have collaborated with each other between 2011-2015, the figure above only shows collaboration counts greater than 50. VU acts as a hub of collaboration between members of the network, and the volume of collaborations between the University of Bergen and other members can be seen clearly. The size of each node indicates the total publication count of the institute, the thickness of the edge indicates the volume of collaboration between members and the colours of nodes indicates member total FWCI, whilst colour of edges indicates FWCI of collaborations between members, with darker nodes and edges having higher FWCI values.
- Page 21: There is a high degree of collaboration between all members in Medicine, and Biochemistry, Genetics and Molecular Biology. These subject areas cover the bulk of all collaborations between members, with the VU and University of Gothenburg collaborating with the most members of the network in Medicine, and VU collaborating the most in Biochemistry, Genetics and Molecular Biology.
- Page 22: There are subject areas with low degrees of collaboration between members, even with individual member totals for these subject areas being quite high. Materials Sciences output per member is high, but overall FWCI for both members and Aurora are low. Engineering output and FWCI is high for individual members and the Network as whole, but overall low collaboration between members.

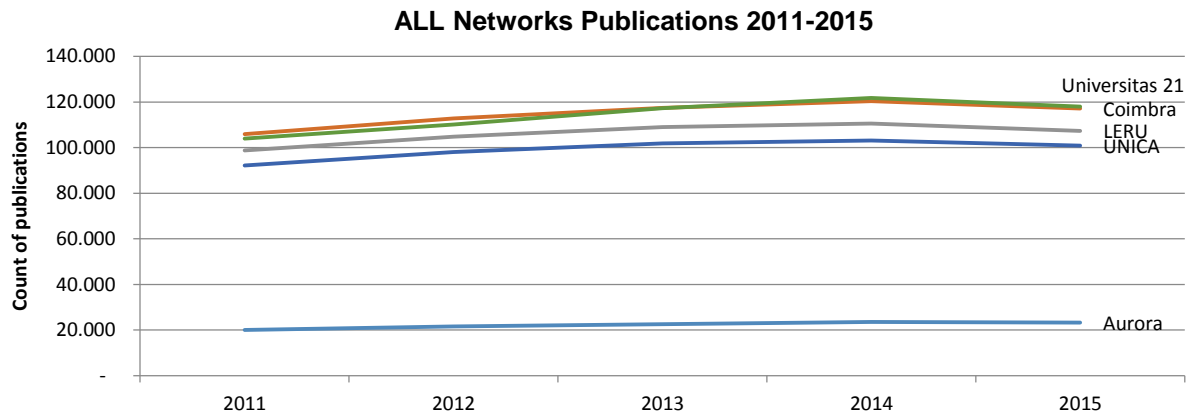


ELSEVIER

Networks comparison – by publication output



Comparator networks: Universitas 21, Coimbra, LERU, UNICA

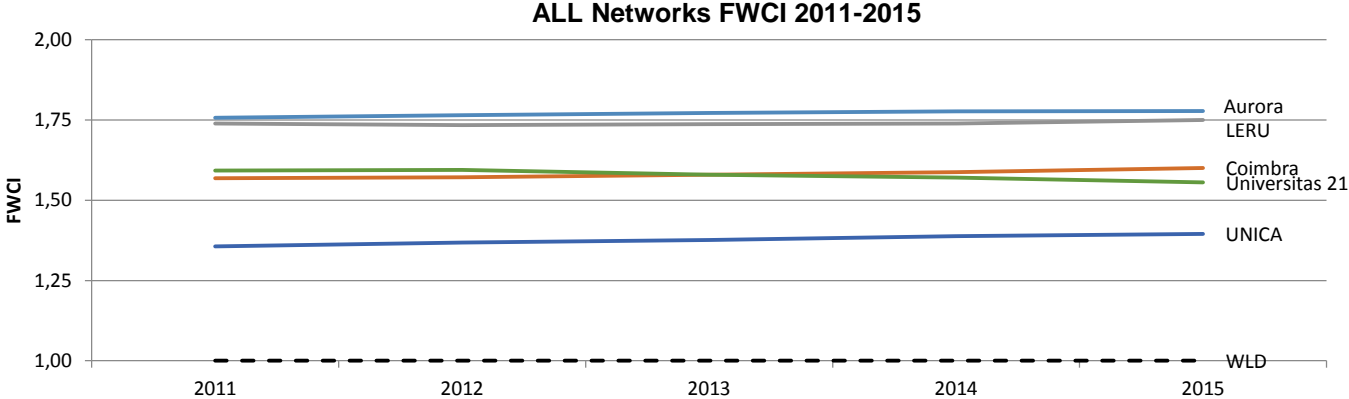


	Publications					Total	CAGR
	2011	2012	2013	2014	2015	2011-2015	11-15
Aurora	20,027	21,545	22,651	23,585	23,332	111,140	3.89%
Coimbra	105,994	112,894	117,515	120,377	117,167	573,947	2.54%
LERU	98,873	104,772	109,052	110,587	107,403	530,687	2.09%
UNICA	92,233	98,158	101,919	103,130	100,885	496,325	2.27%
Universitas 21	103,978	110,176	117,396	121,801	118,054	571,405	3.22%

Networks comparison – by FWCI



Comparator networks: Universitas 21, Coimbra, LERU, UNICA



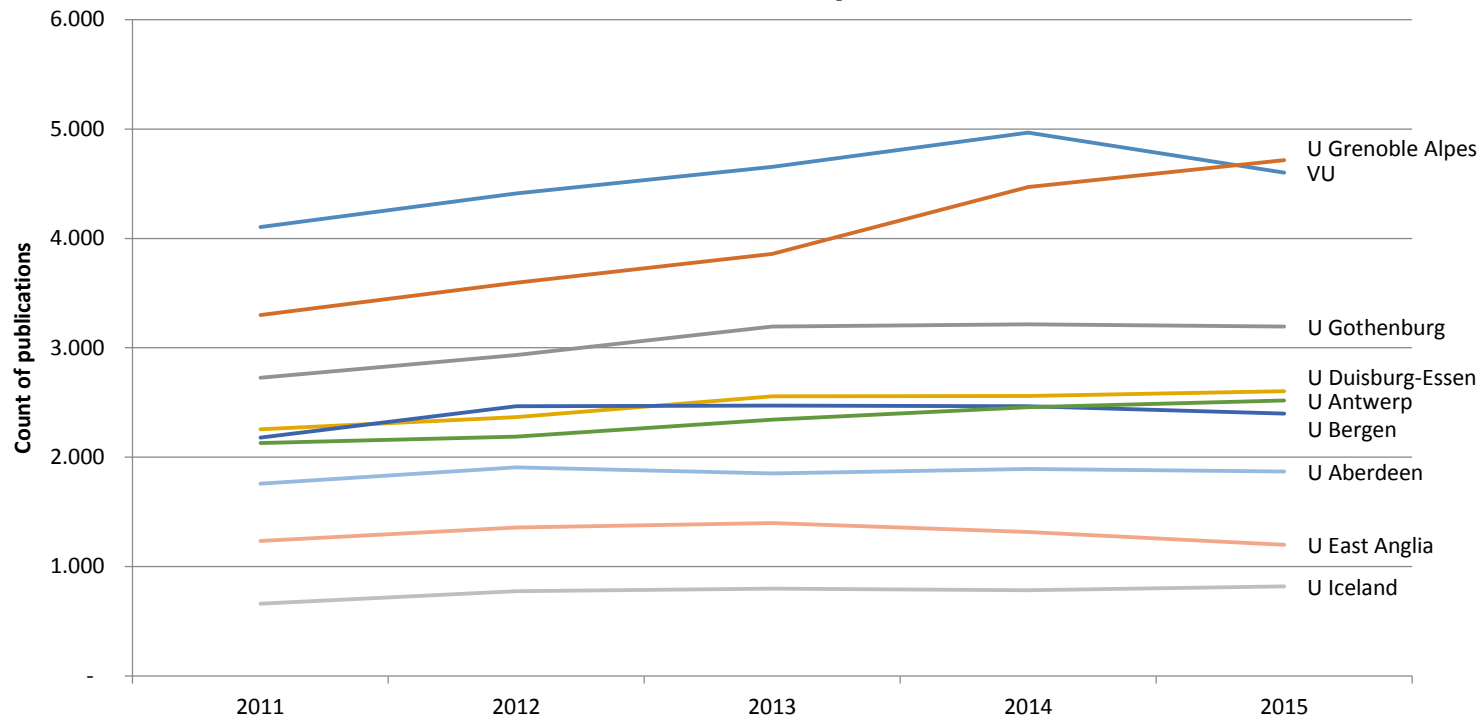
	FWCI					Total	CAGR
	2011	2012	2013	2014	2015	2011-2015	11-15
Aurora	1.757	1.765	1.772	1.777	1.778	1.769	0.30%
Coimbra	1.569	1.572	1.58	1.588	1.601	1.584	0.51%
LERU	1.739	1.734	1.737	1.739	1.75	1.742	0.16%
UNICA	1.356	1.368	1.376	1.388	1.395	1.377	0.71%
Universitas 21	1.593	1.595	1.58	1.571	1.556	1.577	-0.59%

Aurora
Coimbra
LERU
UNICA
Universitas 21

Members of Aurora – total output per member



Aurora member institutions' publications 2011-2015



Members of Aurora – total output per member (con.)

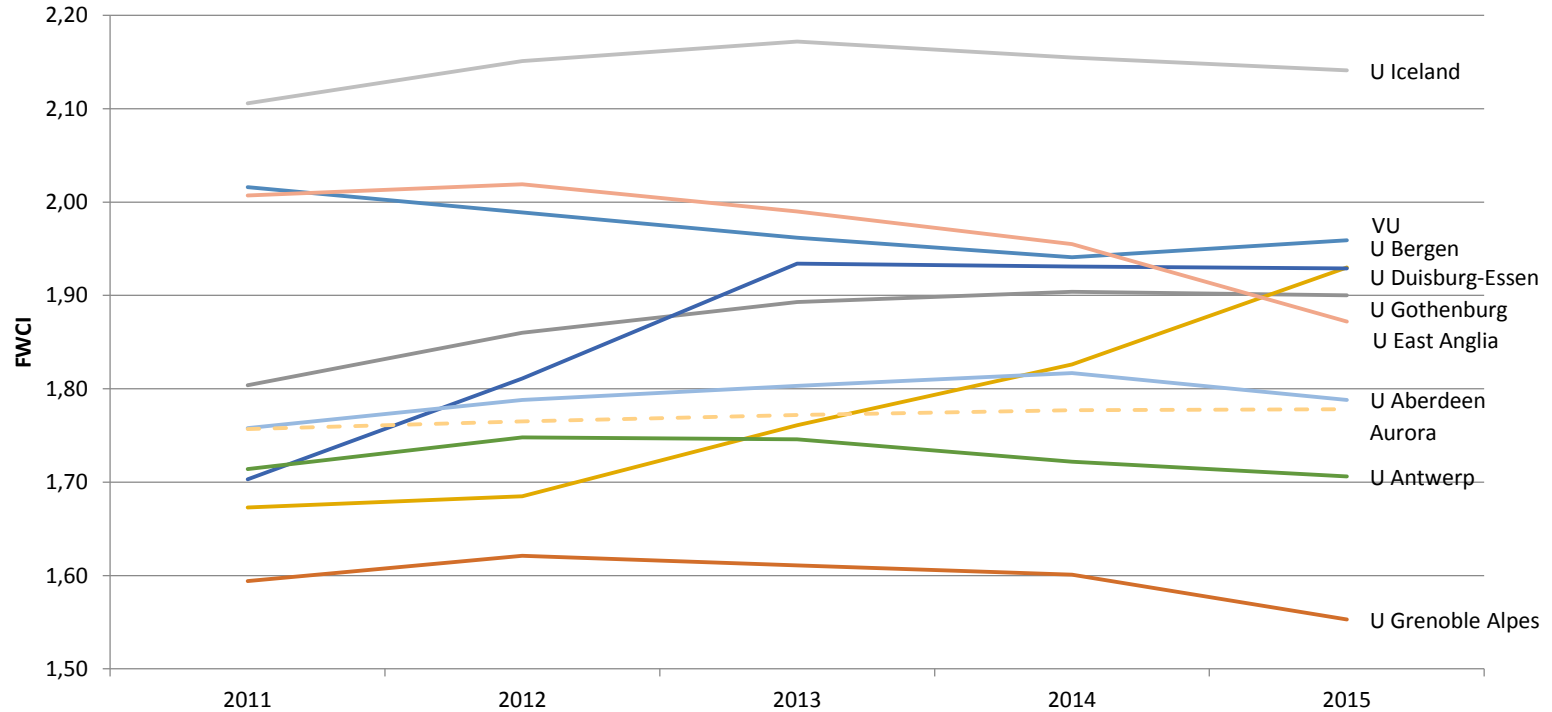


Entity	Publications					Total	CAGR
	2011	2012	2013	2014	2015	2011-2015	2011-2015
Aurora	20,027	21,545	22,651	23,585	23,332	111,140	3.9%
VU	4,103	4,412	4,654	4,968	4,601	22,738	2.91%
U Grenoble Alpes	3,300	3,594	3,857	4,470	4,715	19,936	9.33%
U Gothenburg	2,727	2,933	3,193	3,216	3,193	15,262	4.02%
U Duisburg-Essen	2,256	2,367	2,556	2,559	2,603	12,341	3.64%
U Bergen	2,179	2,466	2,473	2,465	2,397	11,980	2.41%
U Antwerp	2,128	2,189	2,342	2,457	2,518	11,634	4.30%
U Aberdeen	1,758	1,907	1,850	1,893	1,869	9,277	1.54%
U East Anglia	1,235	1,356	1,398	1,315	1,198	6,502	-0.76%
U Iceland	660	776	798	785	818	3,837	5.51%

Members of Aurora – total FWCI per member



Aurora member institutions FWCI 2011-2015



Members of Aurora – total FWCI per member



FWCI Total CAGR

Entity	2011	2012	2013	2014	2015	2011-2015	2011-2015
Aurora	1.757	1.765	1.772	1.777	1.778	1.77	0.3%

VU	2.02	1.99	1.96	1.94	1.96	1.970	-0.71%
U Grenoble Alpes	1.59	1.62	1.61	1.60	1.55	1.585	-0.65%
U Gothenburg	1.80	1.86	1.89	1.90	1.90	1.909	1.30%
U Duisburg-Essen	1.67	1.69	1.76	1.83	1.93	1.807	3.64%
U Bergen	1.70	1.81	1.93	1.93	1.93	1.898	3.16%
U Antwerp	1.71	1.75	1.75	1.72	1.71	1.745	-0.12%
U Aberdeen	1.76	1.79	1.80	1.82	1.79	1.773	0.42%
U East Anglia	2.01	2.02	1.99	1.96	1.87	1.982	-1.73%
U Iceland	2.11	2.15	2.17	2.16	2.14	2.154	0.41%

Members of Aurora – per subject area output per member

Subject Name	Aurora	VU	U Grenoble Alpes	U Gothenburg	U Duisburg-Essen	U Bergen	U Antwerp	U Aberdeen	U East Anglia	U Iceland
All	111,140	22,738	19,936	15,262	12,341	11,980	11,634	9,277	6,502	3,837
Multidisciplinary	1,042	176	237	151	78	102	87	130	87	54
Agricultural and Biological Sciences	10,113	1,558	920	1,551	462	1,609	1,257	1,564	931	496
Arts and Humanities	4,856	1,161	446	653	164	600	588	636	483	181
Biochemistry, Genetics and Molecular Biology	18,945	4,484	2,537	3,201	2,116	1,957	1,875	1,649	1,063	594
Business, Management and Accounting	2,151	601	195	358	224	157	344	98	123	79
Chemical Engineering	2,459	179	714	204	493	175	321	181	146	57
Chemistry	7,194	791	1,994	612	1,086	397	1,080	552	539	197
Computer Science	9,150	1,615	2,539	478	1,517	951	939	580	287	281
Decision Sciences	1,091	299	175	99	136	68	213	56	39	14
Earth and Planetary Sciences	7,567	863	2,436	502	93	1,503	263	685	728	673
Economics, Econometrics and Finance	2,119	564	136	368	236	102	254	133	284	66
Energy	1,486	107	372	86	251	175	168	158	72	110
Engineering	8,785	643	3,490	479	1,710	462	874	651	296	291
Environmental Science	6,685	1,284	735	847	278	723	846	981	890	272
Immunology and Microbiology	4,295	904	424	784	493	420	429	507	268	138
Materials Science	6,982	249	2,986	416	1,227	138	1,073	447	257	205
Mathematics	6,575	993	1,842	309	997	828	572	600	363	132
Medicine	47,914	13,273	4,456	8,717	5,691	5,124	4,586	3,647	2,223	1,315
Neuroscience	5,584	1,867	508	939	541	560	599	448	145	110
Nursing	2,887	848	193	649	125	323	152	251	252	147
Pharmacology, Toxicology and Pharmaceutics	2,916	662	332	434	323	193	471	276	188	67
Physics and Astronomy	13,357	1,114	5,983	694	1,531	1,178	1,903	662	284	549
Psychology	4,610	1,787	367	701	252	532	264	364	263	148
Social Sciences	9,763	2,220	603	1,638	578	1,042	1,275	982	1,198	340
Veterinary	326	51	25	30	21	29	110	35	9	23
Dentistry	858	179	12	489	12	117	7	35	3	17
Health Professions	1,814	621	185	364	115	143	165	93	109	36

Members of Aurora – per subject area share per member

Entity share	2011-2015									
	Aurora	VU	U Grenoble Alpes	U Gothenburg	U Duisburg-Essen	U Bergen	U Antwerp	U Aberdeen	U East Anglia	U Iceland
All	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Multidisciplinary	0.94%	0.77%	1.19%	0.99%	0.63%	0.85%	0.75%	1.40%	1.34%	1.41%
Agricultural and Biological Sciences	9.10%	6.85%	4.61%	10.16%	3.74%	13.43%	10.80%	16.86%	14.32%	12.93%
Arts and Humanities	4.37%	5.11%	2.24%	4.28%	1.33%	5.01%	5.05%	6.86%	7.43%	4.72%
Biochemistry, Genetics and Molecular Biology	17.05%	19.72%	12.73%	20.97%	17.15%	16.34%	16.12%	17.78%	16.35%	15.48%
Business, Management and Accounting	1.94%	2.64%	0.98%	2.35%	1.82%	1.31%	2.96%	1.06%	1.89%	2.06%
Chemical Engineering	2.21%	0.79%	3.58%	1.34%	3.99%	1.46%	2.76%	1.95%	2.25%	1.49%
Chemistry	6.47%	3.48%	10.00%	4.01%	8.80%	3.31%	9.28%	5.95%	8.29%	5.13%
Computer Science	8.23%	7.10%	12.74%	3.13%	12.29%	7.94%	8.07%	6.25%	4.41%	7.32%
Decision Sciences	0.98%	1.31%	0.88%	0.65%	1.10%	0.57%	1.83%	0.60%	0.60%	0.36%
Earth and Planetary Sciences	6.81%	3.80%	12.22%	3.29%	0.75%	12.55%	2.26%	7.38%	11.20%	17.54%
Economics, Econometrics and Finance	1.91%	2.48%	0.68%	2.41%	1.91%	0.85%	2.18%	1.43%	4.37%	1.72%
Energy	1.34%	0.47%	1.87%	0.56%	2.03%	1.46%	1.44%	1.70%	1.11%	2.87%
Engineering	7.90%	2.83%	17.51%	3.14%	13.86%	3.86%	7.51%	7.02%	4.55%	7.58%
Environmental Science	6.01%	5.65%	3.69%	5.55%	2.25%	6.04%	7.27%	10.57%	13.69%	7.09%
Immunology and Microbiology	3.86%	3.98%	2.13%	5.14%	3.99%	3.51%	3.69%	5.47%	4.12%	3.60%
Materials Science	6.28%	1.10%	14.98%	2.73%	9.94%	1.15%	9.22%	4.82%	3.95%	5.34%
Mathematics	5.92%	4.37%	9.24%	2.02%	8.08%	6.91%	4.92%	6.47%	5.58%	3.44%
Medicine	43.11%	58.37%	22.35%	57.12%	46.11%	42.77%	39.42%	39.31%	34.19%	34.27%
Neuroscience	5.02%	8.21%	2.55%	6.15%	4.38%	4.67%	5.15%	4.83%	2.23%	2.87%
Nursing	2.60%	3.73%	0.97%	4.25%	1.01%	2.70%	1.31%	2.71%	3.88%	3.83%
Pharmacology, Toxicology and Pharmaceutics	2.62%	2.91%	1.67%	2.84%	2.62%	1.61%	4.05%	2.98%	2.89%	1.75%
Physics and Astronomy	12.02%	4.90%	30.01%	4.55%	12.41%	9.83%	16.36%	7.14%	4.37%	14.31%
Psychology	4.15%	7.86%	1.84%	4.59%	2.04%	4.44%	2.27%	3.92%	4.04%	3.86%
Social Sciences	8.78%	9.76%	3.02%	10.73%	4.68%	8.70%	10.96%	10.59%	18.43%	8.86%
Veterinary	0.29%	0.22%	0.13%	0.20%	0.17%	0.24%	0.95%	0.38%	0.14%	0.60%
Dentistry	0.77%	0.79%	0.06%	3.20%	0.10%	0.98%	0.06%	0.38%	0.05%	0.44%
Health Professions	1.63%	2.73%	0.93%	2.39%	0.93%	1.19%	1.42%	1.00%	1.68%	0.94%

Members of Aurora – per subject FWCI per member



Subject Name	FWCI 2011-2015									
	Aurora	VU	U Grenoble Alpes	U Gothenburg	U Duisburg-Essen	U Bergen	U Antwerp	U Aberdeen	U East Anglia	U Iceland
All	1.77	1.97	1.59	1.91	1.81	1.90	1.74	1.77	1.98	2.15
Multidisciplinary	3.00	4.09	2.32	3.52	3.28	3.98	3.02	2.51	4.59	7.33
Agricultural and Biological Sciences	1.74	1.96	2.15	1.69	1.64	1.56	1.51	1.72	2.18	1.42
Arts and Humanities	1.89	2.03	0.94	2.03	1.43	3.07	1.67	1.86	1.35	1.89
Biochemistry, Genetics and Molecular Biology	1.51	1.74	1.33	1.58	1.68	1.49	1.43	1.60	1.61	3.23
Business, Management and Accounting	1.72	2.27	1.46	1.56	1.10	1.35	1.93	1.28	1.69	1.09
Chemical Engineering	1.30	1.59	1.57	1.11	1.14	0.90	1.35	1.10	1.31	1.03
Chemistry	1.21	1.33	1.38	1.25	1.07	0.97	1.24	0.98	1.04	1.22
Computer Science	1.33	1.45	1.06	1.22	1.53	1.59	1.42	1.29	1.02	1.64
Decision Sciences	1.34	1.36	1.47	1.23	1.35	1.21	1.25	1.31	1.61	1.54
Earth and Planetary Sciences	2.00	2.09	1.90	1.55	1.55	2.27	2.21	1.68	2.46	2.47
Economics, Econometrics and Finance	1.46	1.71	1.26	1.65	1.13	1.35	1.17	1.40	1.83	1.31
Energy	1.50	2.13	1.37	1.39	1.25	1.66	2.18	1.52	1.65	0.65
Engineering	1.66	1.98	1.45	1.37	1.67	1.59	2.01	1.70	2.41	2.64
Environmental Science	1.92	2.20	1.94	1.73	1.67	1.66	1.90	1.83	2.60	1.34
Immunology and Microbiology	1.59	1.85	1.41	1.43	1.34	1.29	1.40	2.14	2.31	1.49
Materials Science	1.16	1.10	1.16	1.16	1.09	0.76	1.53	0.80	1.18	0.92
Mathematics	1.33	1.42	1.20	1.21	1.29	1.71	1.16	1.29	1.51	1.54
Medicine	1.91	1.95	1.76	2.08	2.19	1.93	1.70	1.98	2.05	2.23
Neuroscience	1.43	1.63	1.16	1.47	1.32	1.50	1.39	1.34	1.25	2.00
Nursing	1.91	2.23	0.67	1.73	1.70	1.72	4.17	1.81	1.98	1.51
Pharmacology, Toxicology and Pharmaceutics	1.56	1.66	1.47	1.39	1.48	1.12	1.61	1.87	1.90	1.63
Physics and Astronomy	1.58	2.03	1.57	1.44	1.25	2.22	1.92	1.23	1.69	1.67
Psychology	1.34	1.51	0.91	1.27	1.14	1.35	1.20	1.69	1.05	1.17
Social Sciences	1.66	1.94	1.04	1.49	1.30	1.92	1.54	1.77	1.98	1.47
Veterinary	1.87	1.88	0.77	2.04	1.16	1.97	2.15	2.03	2.85	1.35
Dentistry	1.63	1.66	0.77	1.68	2.35	1.35	0.95	1.05	3.05	3.99
Health Professions	1.49	1.80	1.17	1.45	0.98	1.34	1.63	1.32	1.45	1.26

Networks comparison – per subject FWCI per network



Subject Name	FWCI				
	Aurora	Coimbra	2011-2015 LERU	UNICA	Universitas 21
All	1.77	1.58	1.74	1.38	1.58
Multidisciplinary	3.00	2.52	2.69	2.30	1.93
Agricultural and Biological Sciences	1.74	1.53	1.67	1.36	1.55
Arts and Humanities	1.89	1.48	1.67	1.25	1.77
Biochemistry, Genetics and Molecular Biology	1.51	1.38	1.48	1.24	1.34
Business, Management and Accounting	1.72	1.74	2.07	1.43	1.77
Chemical Engineering	1.30	1.35	1.45	1.10	1.45
Chemistry	1.21	1.23	1.36	0.98	1.39
Computer Science	1.33	1.51	1.62	1.30	1.46
Decision Sciences	1.34	1.38	1.46	1.16	1.28
Earth and Planetary Sciences	2.00	1.63	1.81	1.43	1.75
Economics, Econometrics and Finance	1.46	1.50	1.68	1.26	1.53
Energy	1.50	1.60	1.73	1.30	1.59
Engineering	1.66	1.78	1.88	1.49	1.56
Environmental Science	1.92	1.54	1.74	1.40	1.60
Immunology and Microbiology	1.59	1.45	1.55	1.34	1.45
Materials Science	1.16	1.42	1.58	1.13	1.45
Mathematics	1.33	1.40	1.51	1.17	1.33
Medicine	1.91	1.64	1.78	1.50	1.60
Neuroscience	1.43	1.32	1.41	1.25	1.25
Nursing	1.91	1.61	1.65	1.54	1.55
Pharmacology, Toxicology and Pharmaceutics	1.56	1.53	1.66	1.35	1.46
Physics and Astronomy	1.58	1.49	1.62	1.26	1.51
Psychology	1.34	1.25	1.39	1.22	1.33
Social Sciences	1.66	1.46	1.65	1.26	1.55
Veterinary	1.87	1.57	1.62	1.38	1.65
Dentistry	1.63	1.46	1.58	1.46	1.53
Health Professions	1.49	1.36	1.51	1.33	1.44

Networks comparison – per subject FWCI comparison



Subject Name	FWCI				
	Aurora	Coimbra	2011-2015		
			LERU	UNICA	Universitas 21
All	1.77	1.58	1.74	1.38	1.58
Multidisciplinary	3.00	2.52	2.69	2.30	1.93
Agricultural and Biological Sciences	1.74	1.53	1.67	1.36	1.55
Arts and Humanities	1.89	1.48	1.67	1.25	1.77
Biochemistry, Genetics and Molecular Biology	1.51	1.38	1.48	1.24	1.34
Business, Management and Accounting	1.72	1.74	2.07	1.43	1.77
Chemical Engineering	1.30	1.35	1.45	1.10	1.45
Chemistry	1.21	1.23	1.36	0.98	1.39
Computer Science	1.33	1.51	1.62	1.30	1.46
Decision Sciences	1.34	1.38	1.46	1.16	1.28
Earth and Planetary Sciences	2.00	1.63	1.81	1.43	1.75
Economics, Econometrics and Finance	1.46	1.50	1.68	1.26	1.53
Energy	1.50	1.60	1.73	1.30	1.59
Engineering	1.66	1.78	1.88	1.49	1.56
Environmental Science	1.92	1.54	1.74	1.40	1.60
Immunology and Microbiology	1.59	1.45	1.55	1.34	1.45
Materials Science	1.16	1.42	1.58	1.13	1.45
Mathematics	1.33	1.40	1.51	1.17	1.33
Medicine	1.91	1.64	1.78	1.50	1.60
Neuroscience	1.43	1.32	1.41	1.25	1.25
Nursing	1.91	1.61	1.65	1.54	1.55
Pharmacology, Toxicology and Pharmaceutics	1.56	1.53	1.66	1.35	1.46
Physics and Astronomy	1.58	1.49	1.62	1.26	1.51
Psychology	1.34	1.25	1.39	1.22	1.33
Social Sciences	1.66	1.46	1.65	1.26	1.55
Veterinary	1.87	1.57	1.62	1.38	1.65
Dentistry	1.63	1.46	1.58	1.46	1.53
Health Professions	1.49	1.36	1.51	1.33	1.44

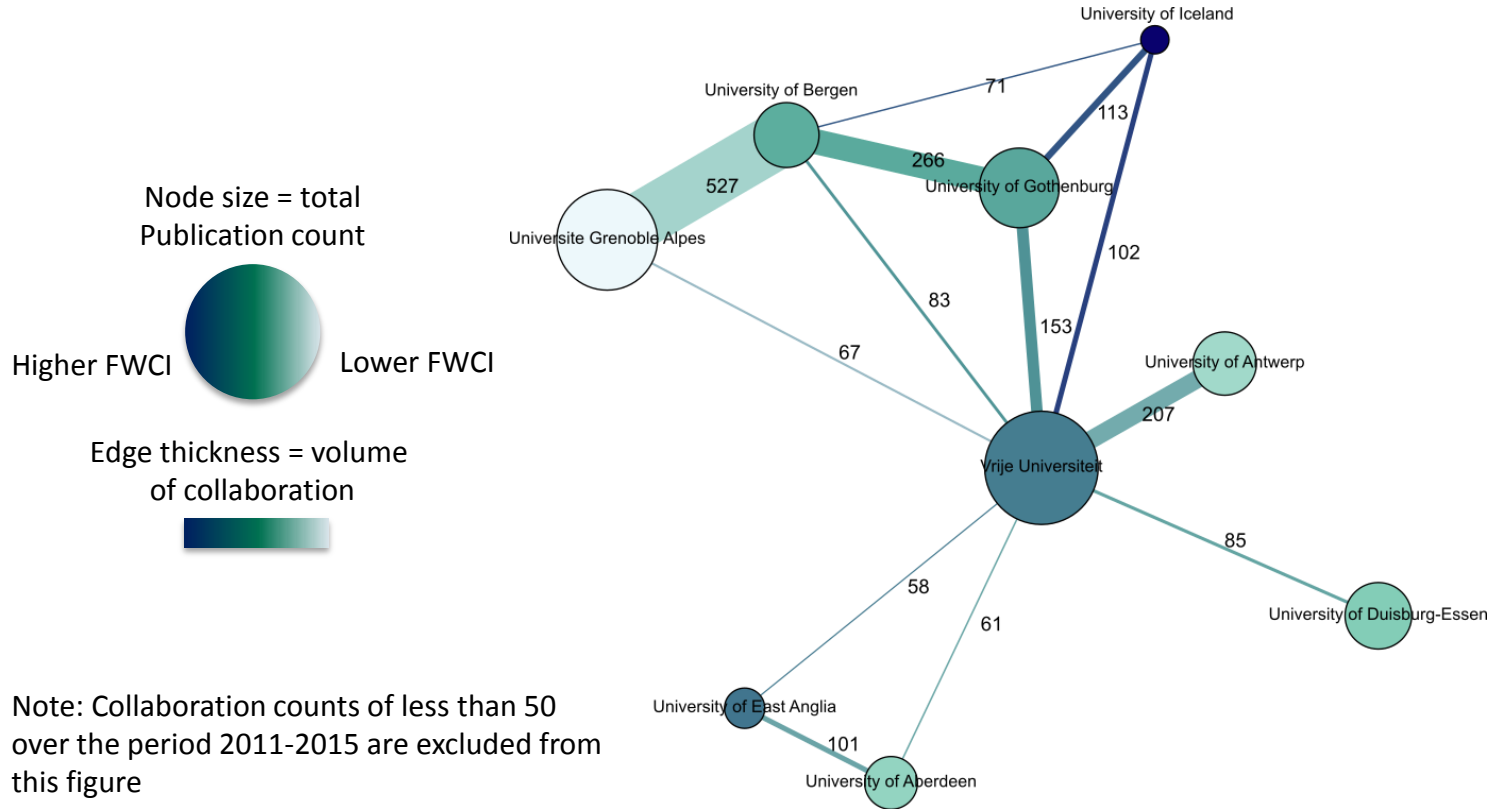
Aurora – collaboration between members



Name	U Grenoble				U Duisburg-		U Gothenburg	U Iceland	VU
	Alpes	U Aberdeen	U Antwerp	U Bergen	Essen	U East Anglia			
U Grenoble Alpes		32	43	527	21	24	49	22	67
U Aberdeen	32		26	39	16	101	33	43	61
U Antwerp	43	26		33	44	13	38	16	207
U Bergen	527	39	33		29	38	266	71	83
U Duisburg- Essen	21	16	44	29		-	50	25	85
U East Anglia	24	101	13	38			24	20	58
U Goth	49	33	38	266	50	24		113	153
U Iceland	22	43	16	71	25	20	113		102
VU	67	61	207	83	85	58	153	102	

2011-2015

Aurora – collaboration between members



Aurora – high collaboration subject areas between members



Medicine 2011-2015 Total FWCI for network: **1.91**. Total count for network: **47,914**

Name	U Grenoble				U Duisburg-		U East Anglia	U Gothenburg	U Iceland	VU
	Alpes	U Aberdeen	U Antwerp	U Bergen	Essen					
U Grenoble Alpes		16	28	17	12	3	34	7	40	
U Aberdeen	16		14	12	11	72	20	13	42	
U Antwerp	28	14		17	38	3	29	7	127	
U Bergen	17	12	17		16	5	204	25	49	
U Duisburg-Essen	12	11	38	16		-	38	7	60	
U East Anglia	3	72	3	5	-		7	6	3	
U Gothenburg	34	20	29	204	38	7		70	118	
U Iceland	7	13	7	25	7	6	70		67	
VU	40	42	127	49	60	3	118	67		

Biochemistry, Genetics and Molecular Biology 2011-2015 Total FWCI for network: **1.51**. Total count for network: **18,945**

Name	U Grenoble				U Duisburg-		U East Anglia	U Gothenburg	U Iceland	VU
	Alpes	U Aberdeen	U Antwerp	U Bergen	Essen					
U Grenoble Alpes		12	5	9	4	5	16	7	21	
U Aberdeen	12		9	4	4	16	14	18	27	
U Antwerp	5	9		1	14	1	7	8	61	
U Bergen	9	4	1		22	3	70	11	27	
U Duisburg-Essen	4	4	14	22		-	23	16	33	
U East Anglia	5	16	1	3	-		4	6	2	
U Gothenburg	16	14	7	70	23	4		34	57	
U Iceland	7	18	8	11	16	6	34		60	
VU	21	27	61	27	33	2	57	60		

Aurora – low collaboration subject areas between members



Materials Sciences 2011-2015 Total FWCI for network: **1.16**. Total count for network: **6,982**.

Name	U Grenoble				U Duisburg-Essen				VU
	Alpes	U Aberdeen	U Antwerp	U Bergen	U East Anglia	U Gothenburg	U Iceland		
U Grenoble Alpes		2	3	-	5	-	3	-	-
U Aberdeen	2		-	-	-	1	-	-	-
U Antwerp	3	-		-	1	-	-	-	-
U Bergen	-	-	-		-	-	1	-	-
U Duisburg-Essen	5	-	1	-		-	1	-	-
U East Anglia	-	1	-	-		-	-	-	-
U Gothenburg	3	-	-	1	1		-	-	-
U Iceland	-	-	-	-	-	-		-	-
VU	-	-	-	-	-	-	-		-

Engineering 2011-2015 Total FWCI for network: **1.66**. Total count for network: **8,784**.

Name	U Grenoble				U Duisburg-Essen				VU
	Alpes	U Aberdeen	U Antwerp	U Bergen	U East Anglia	U Gothenburg	U Iceland		
U Grenoble Alpes		2	4	71	2	-	2	1	1
U Aberdeen	2		-	1	-	1	-	1	-
U Antwerp	4	-		5	-	2	-	-	5
U Bergen	71	1	5		-	1	3	1	-
U Duisburg-Essen	2	-	-	-		-	-	-	-
U East Anglia	-	1	2	1		-	1	-	8
U Gothenburg	2	-	-	3	-	1		-	2
U Iceland	1	1	-	1	-	-	-		1
VU	1	-	5	-	-	8	2	1	

Methodology and rationale

Our methodology is based on the theoretical principles and best practices developed in the field of quantitative science and technology studies, particularly in science and technology indicators research. The Handbook of Quantitative Science and Technology Research: The Use of Publication and Patent Statistics in Studies of S&T Systems (Moed, Glänzel and Schmoch, 2004)¹ gives a good overview of this field and is based on the pioneering work of Derek de Solla Price (1978)², Eugene Garfield (1979)³ and Francis Narin (1976)⁴ in the USA, and Christopher Freeman, Ben Martin and John Irvine in the UK (1981, 1987)⁵, and in several European institutions including the Centre for Science and Technology Studies at Leiden University, the Netherlands, and the Library of the Academy of Sciences in Budapest, Hungary.

The analyses of bibliometric data in this report are based on recognised advanced indicators (e.g., the concept of relative citation impact rates). Our base assumption is that such indicators are useful and valid, though imperfect and partial measures, in the sense that their numerical values are determined by research performance and related concepts, but also by other, influencing factors that may cause systematic biases. In the past decade, the field of indicators research has developed a best practices which state how indicator results should be interpreted and which influencing factors should be taken into account. Our methodology builds on these practices.

Data Source – Scopus

Scopus was developed by and is owned by Elsevier. It is the largest abstract and citation database of peer reviewed research literature in the world, with abstracts and citation information from more than 45 million scientific research articles in 20,000 peer-reviewed journals published by over 5,000 publishers spanning all science sectors, including the Arts & Humanities. (Scopus covers more than 3,000 publications in the field of Arts & Humanities). Scopus covers approximately 5900 titles from North-America, 8400 from Europe, 2800 from Asia-Pacific and 800 from Latin-America and Africa. Scopus.com is used by 1,900 customers, with more than 3 million users in 2010. The average click through to full-text rate is 2.1M per month, with over 25.5M in 2010. Scopus currently includes over 47M publications from more than 4000 global publishers. See <http://info.scopus.com> for more information.

Publication output count and type of document

A publication which is co-authored by authors from different institutes counts towards the publication output of each institute. Publication counts are not fractionalised. In this study only Articles, Reviews and Conference Proceedings are considered.

Subject classifications

This report has applied the All Science Journal Classification (ASJC) to assign publications to subject areas.

Titles in Scopus are classified under four broad subject clusters (life sciences, physical sciences, health sciences and social sciences & humanities) which are further divided into 27 major subject areas and 300+ minor subject areas. Titles may belong to more than one subject area.

FWCI

Field-weighted citation impact is an indicator of mean citation impact, and compares the actual number of citations received by an article with the expected number of citations for articles of the same document type (article, review or conference proceeding paper), publication year and subject field.

Where the article is classified in two or more subject fields, the harmonic mean of the actual and expected citation rates is used.

The indicator is therefore always defined with reference to a global baseline of 1.0 and intrinsically accounts for differences in citation accrual over time, differences in citation rates for different document types (reviews typically attract more citations than research articles, for example), as well as subject-specific differences in citation frequencies overall and over time and document types.

CAGR

The Compound Annual Growth Rate is defined as the year-over-year constant growth rate over a specified period of time. Starting with the first value in any series and applying this rate for each of the time intervals yields the amount in the final value of the series.

$$CAGR(t_0,tn)=\frac{V(tn)-V(t_0)}{V(t_0)}\frac{1}{tn-t_0}$$

Where $V(t_0)$ is the starting value, $V(tn)$ is the finishing value, and $tn-t_0$ is the number of the years.

