

Academic and corporate vehicle electrification research

Hans Pohl¹

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(2) Chalmers University of Technology, Sweden

Purpose of study and acknowledgement of funding

Use scientific publications to get perspectives on the global vehicle electrification research landscape with a focus on selected automakers' knowledge production.

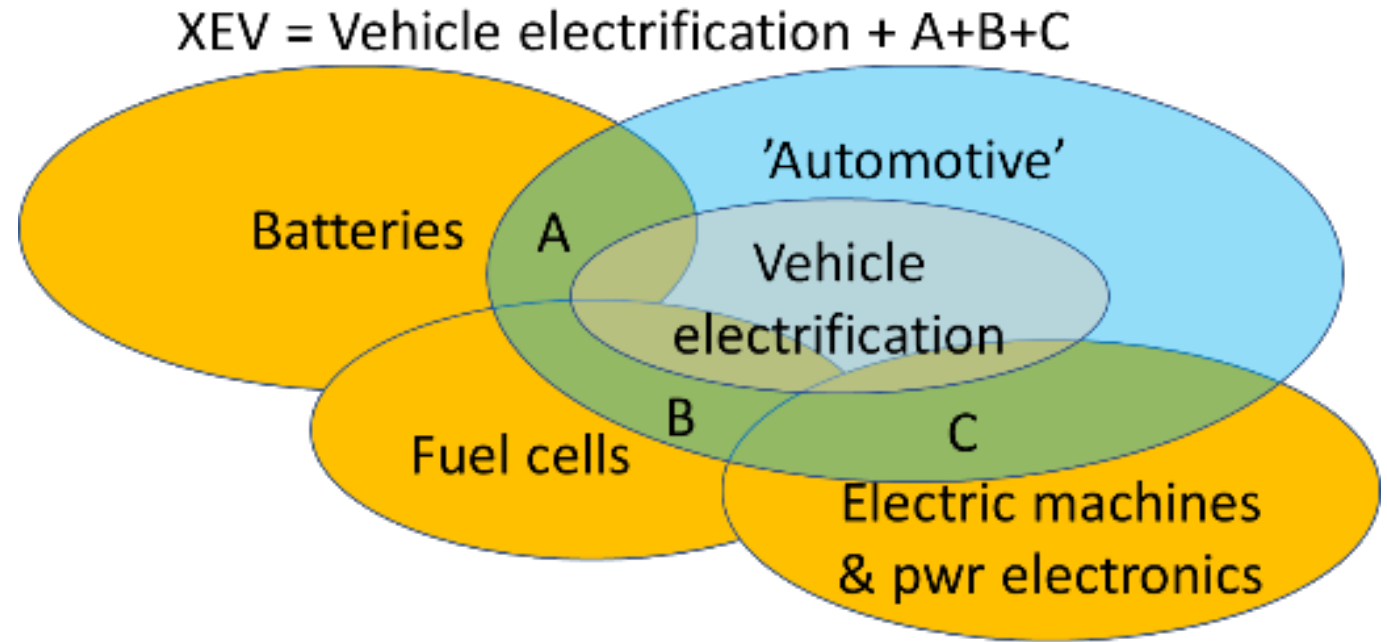
The Swedish Energy Agency has contributed with funding.

Data

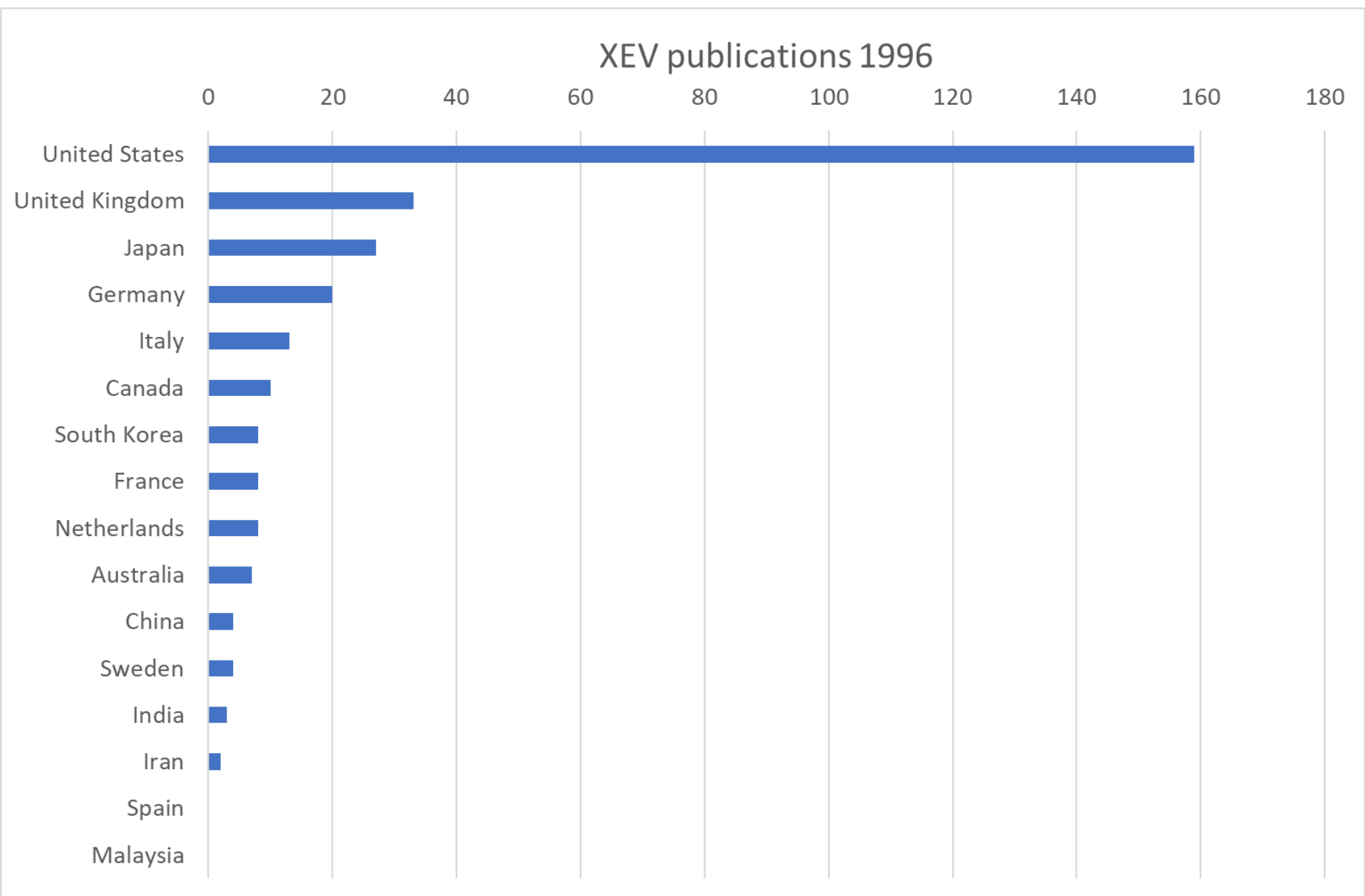
- Publication data from Scopus, the database with the broadest coverage
- Time period 1996 – 2021 and most analyses based on 2016 - 2020
- All types of publications included, such as articles, books, book chapters and conference papers

Method

- Search queries developed to cover 'vehicle electrification' as well as key enabling technologies
- Preliminary results discussed with researchers at universities and research managers at Swedish OEMs
- The selection of automakers was guided by an ambition to cover different parts of the world and some of the largest actors

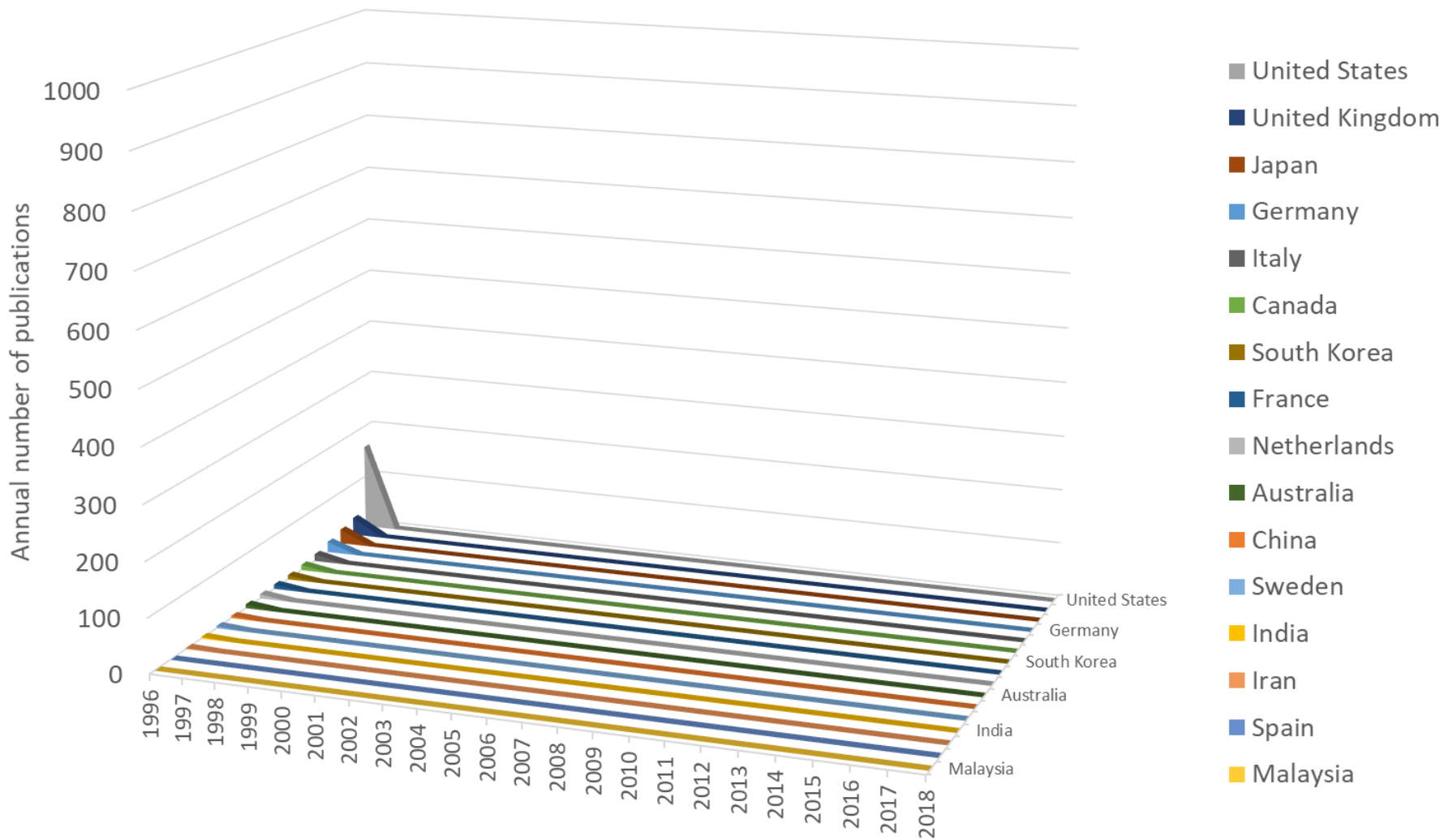


XEV publications top 16 countries (by volume)



1996		
Rank	Share	Country
1	39,9%	United States
2	8,3%	United Kingdom
3	6,8%	Japan
4	5,0%	Germany
5	3,3%	Italy
6	2,5%	Canada
7	2,0%	South Korea
8	2,0%	France
9	2,0%	Netherlands
10	1,8%	Australia
11	1,0%	China
12	1,0%	Sweden
13	0,8%	India
14	0,5%	Iran
15	0,0%	Spain
16	0,0%	Malaysia

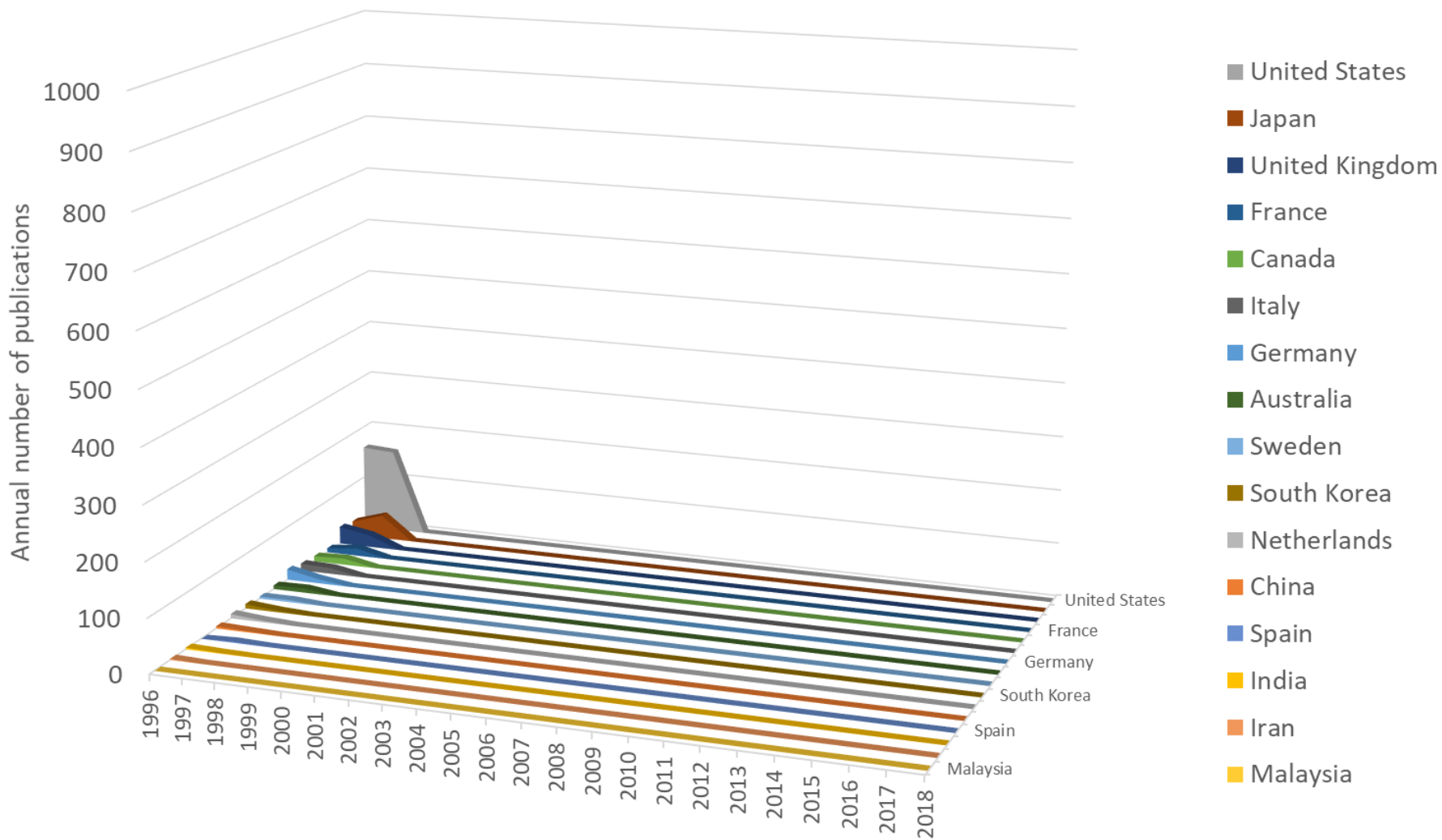
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7	2,0%	South Korea
8	2,0%	France
9	2,0%	Netherlands
10	1,8%	Australia
11	1,0%	China
12	1,0%	Sweden
13	0,8%	India
14	0,5%	Iran
15	0,0%	Spain
16	0,0%	Malaysia

EVS-13 Osaka, Japan

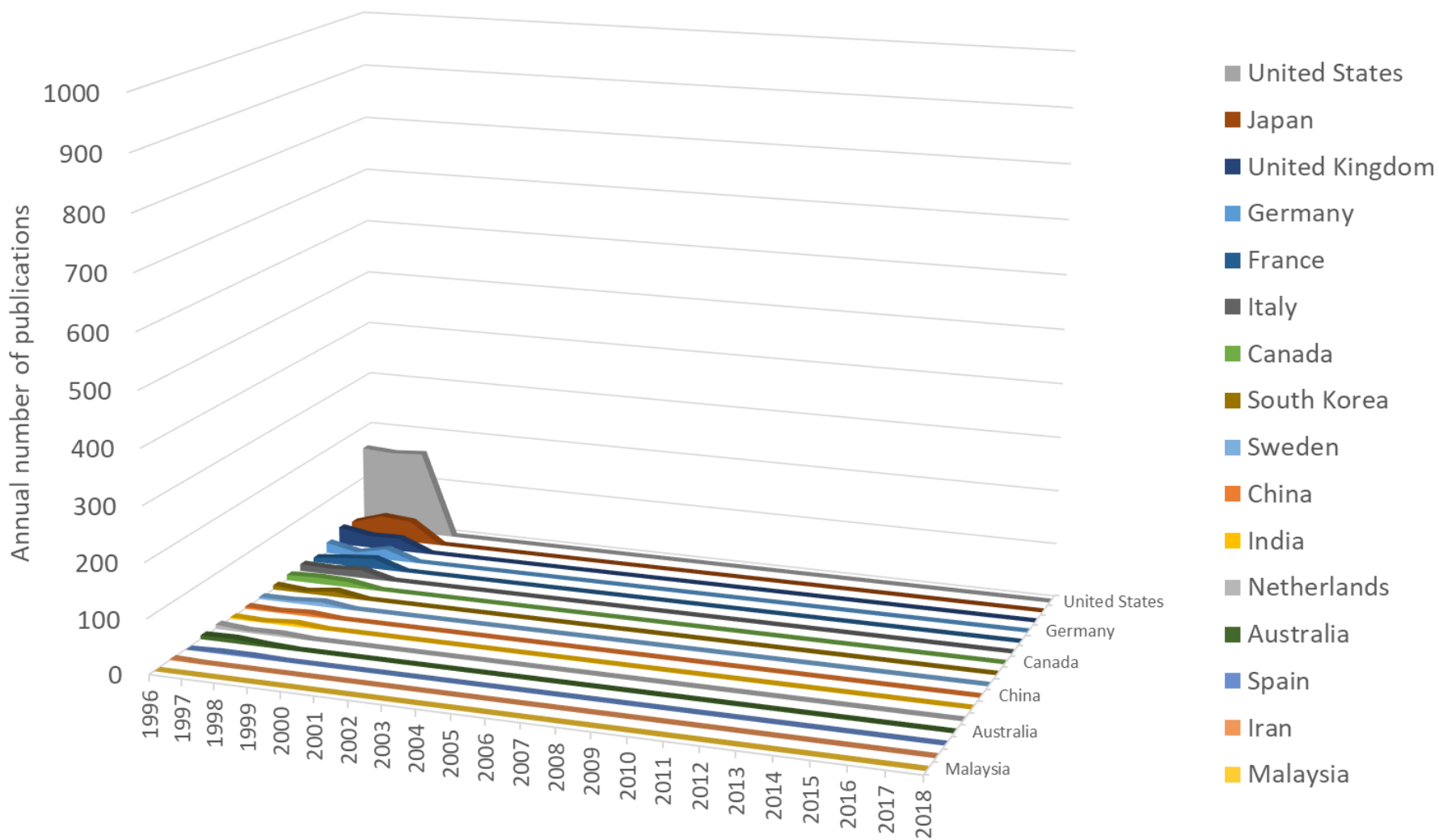
XEV publications top 16 countries (by volume)



1997		
Rank	Share	Country
1	40,4%	United States
2	11,7%	Japan
3	6,0%	United Kingdom
4	3,6%	France
5	3,1%	Canada
6	2,9%	Italy
7	2,1%	Germany
8	2,1%	Australia
9	1,0%	Sweden
10	0,8%	South Korea
11	0,8%	Netherlands
12	0,5%	China
13	0,5%	Spain
14	0,3%	India
15	0,0%	Iran
16	0,0%	Malaysia

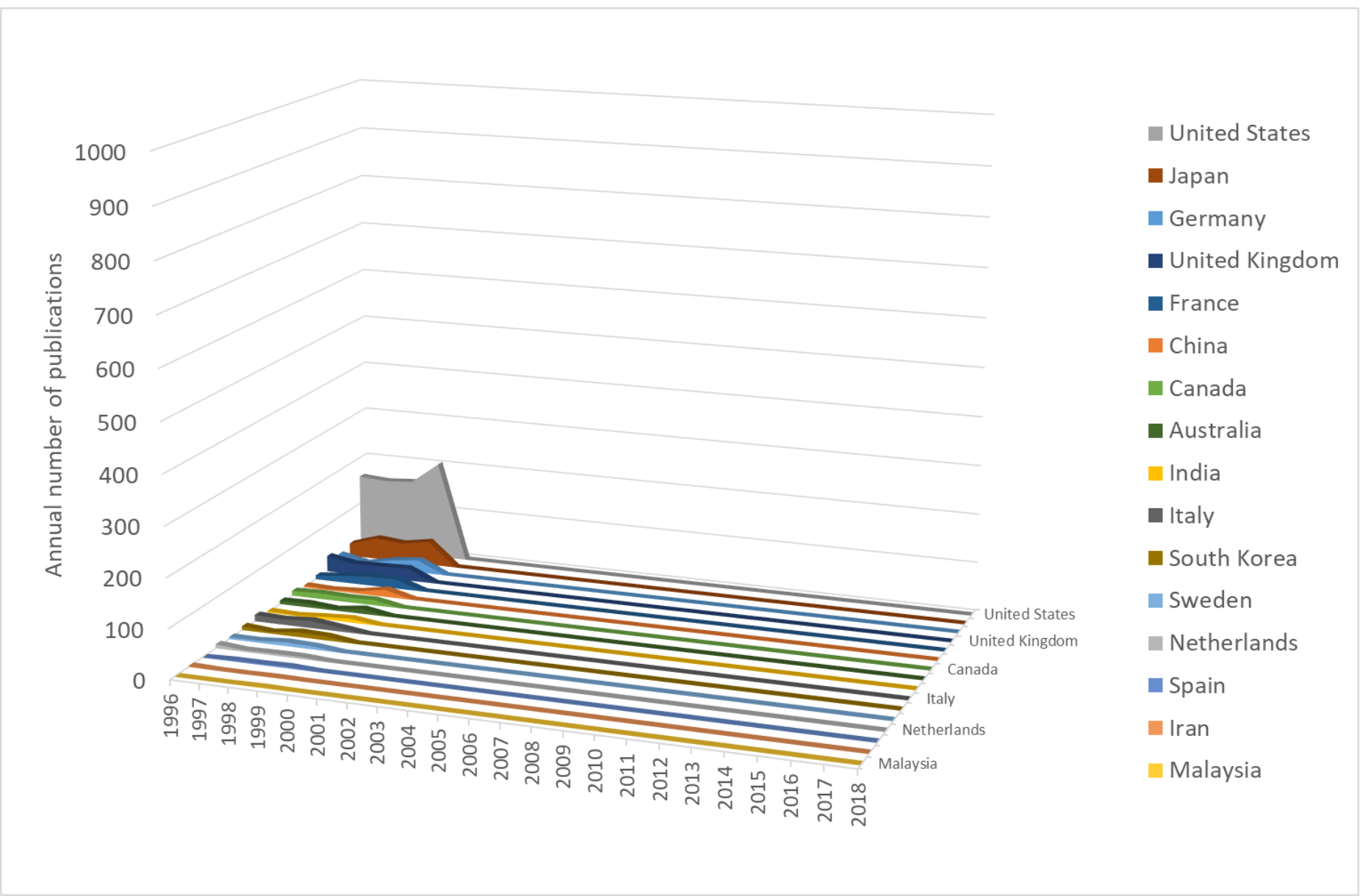
EVS-14 Orlando, USA

XEV publications top 16 countries (by volume)



1998		
Rank	Share	Country
1	41.1%	United States
2	10.3%	Japan
3	6.2%	United Kingdom
4	5.2%	Germany
5	4.9%	France
6	3.9%	Italy
7	2.6%	Canada
8	2.6%	South Korea
9	2.1%	Sweden
10	1.3%	China
11	1.3%	India
12	1.0%	Netherlands
13	0.8%	Australia
14	0.5%	Spain
15	0.0%	Iran
16	0.0%	Malaysia

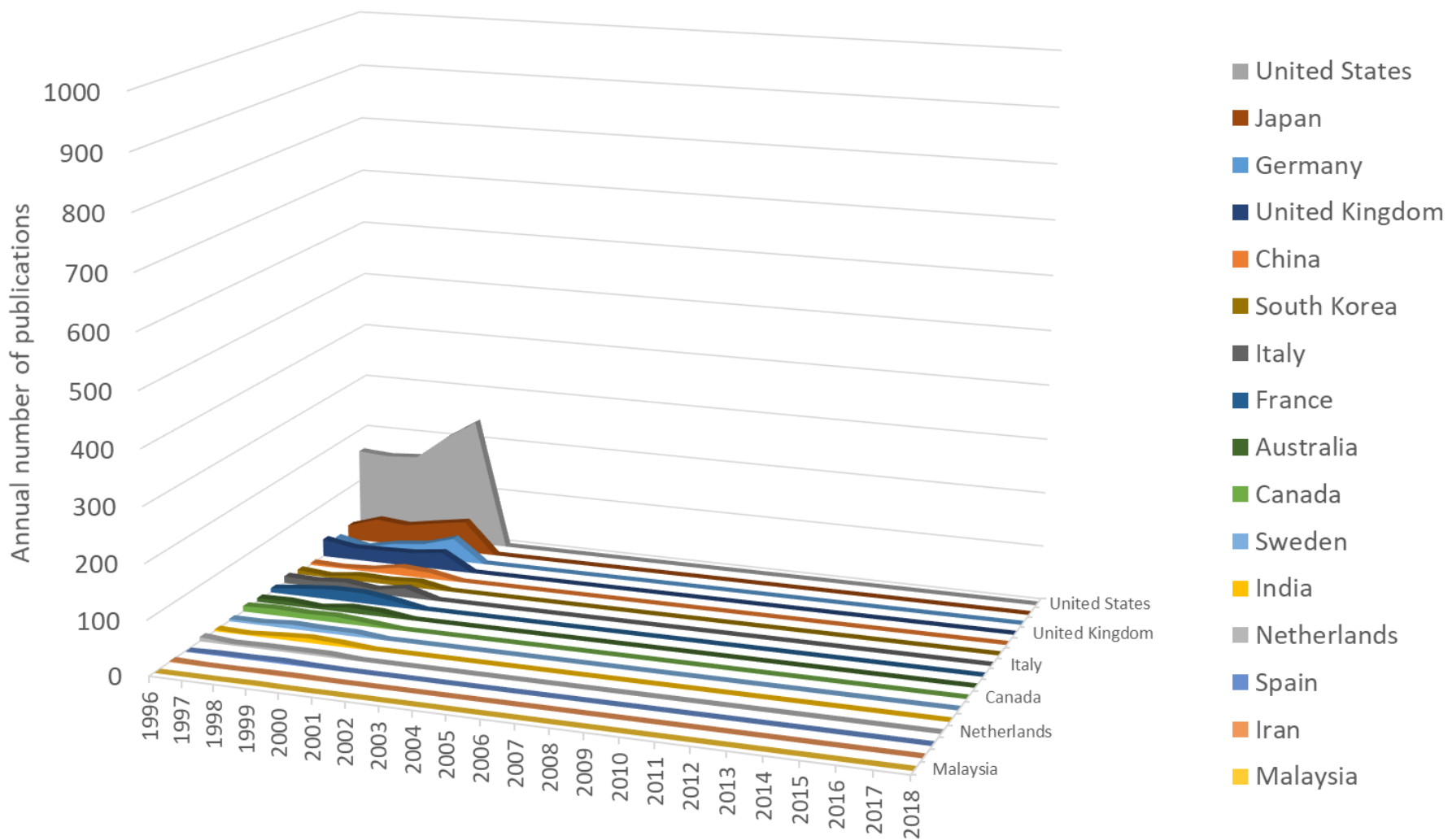
XEV publications top 16 countries (by volume)



1999		
Rank	Share	Country
1	40.8%	United States
2	10.1%	Japan
3	5.2%	Germany
4	5.2%	United Kingdom
5	3.8%	France
6	3.0%	China
7	2.2%	Canada
8	2.0%	Australia
9	1.6%	India
10	1.6%	Italy
11	1.6%	South Korea
12	1.2%	Sweden
13	0.8%	Netherlands
14	0.6%	Spain
15	0.2%	Iran
16	0.2%	Malaysia

EVS-16 Beijing, China

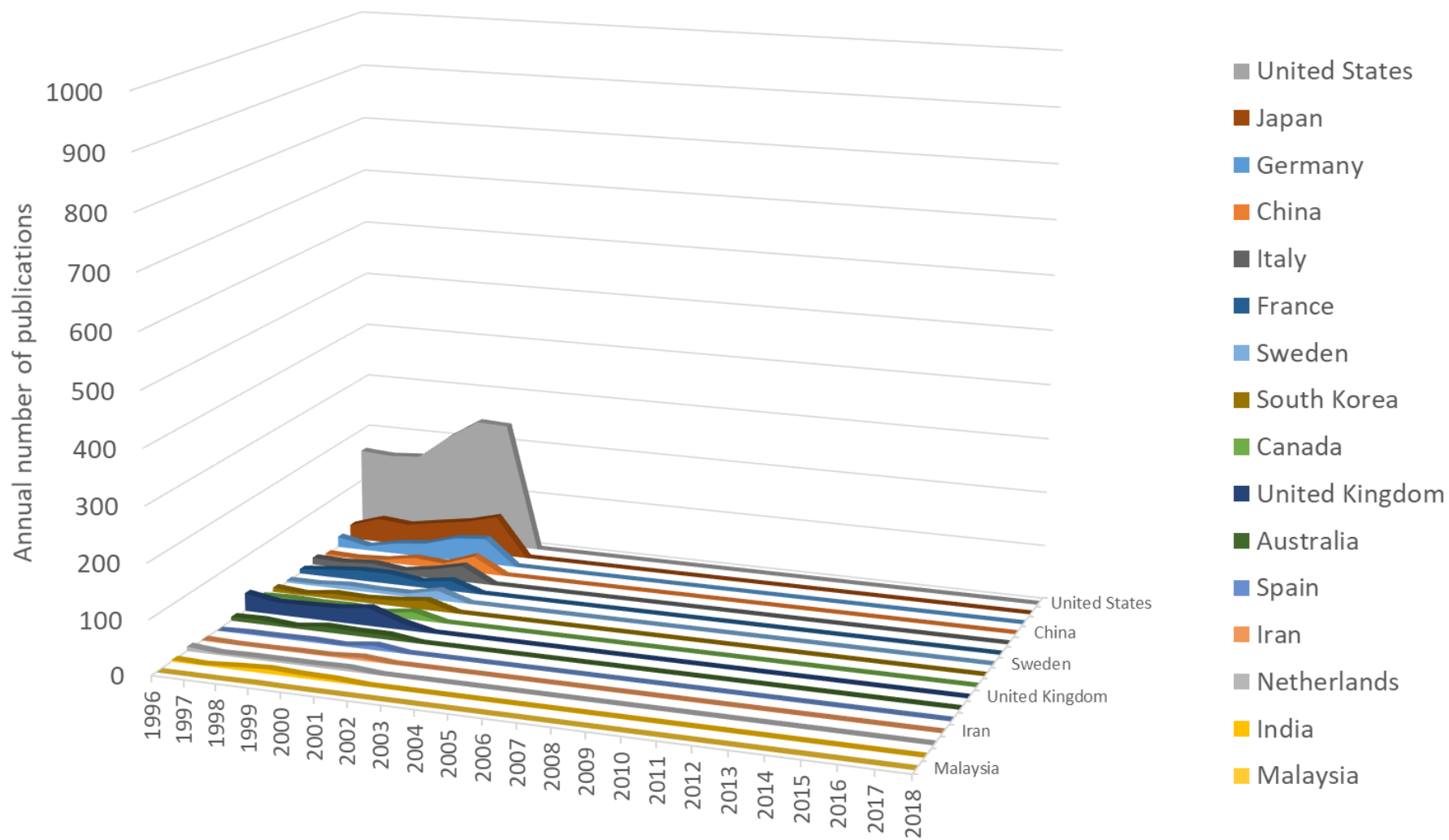
XEV publications top 16 countries (by volume)



2000		
Rank	Share	Country
1	41,7%	United States
2	10,3%	Japan
3	7,5%	Germany
4	5,8%	United Kingdom
5	3,0%	Italy
6	1,9%	China
7	1,9%	South Korea
8	1,9%	France
9	1,4%	Australia
10	1,0%	Canada
11	1,0%	Sweden
12	0,9%	India
13	0,7%	Netherlands
14	0,2%	Spain
15	0,2%	Iran
16	0,0%	Malaysia

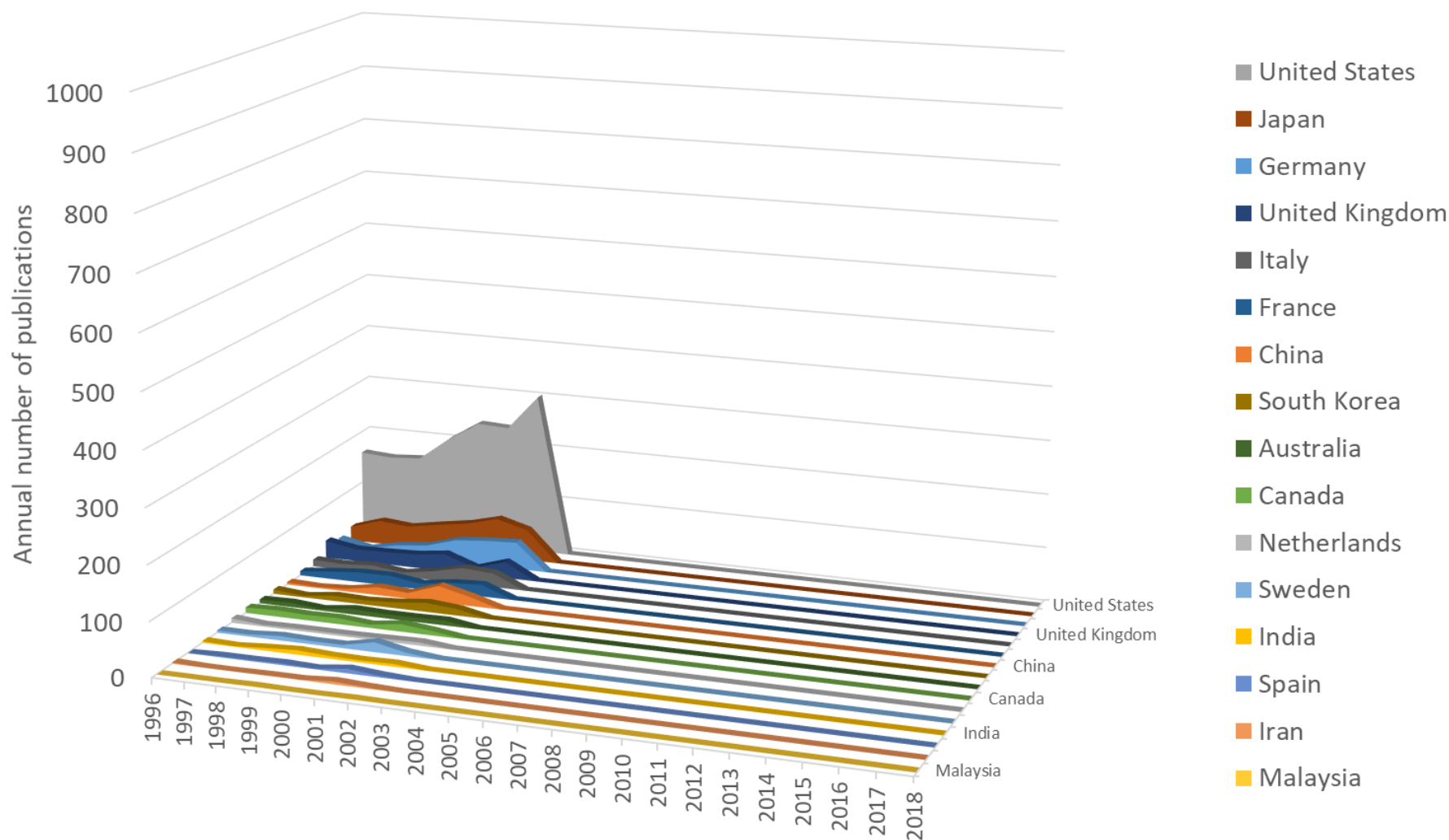
EVS-17 Montreal,
Canada

XEV publications top 16 countries (by volume)



2001		
Rank	Share	Country
1	36,8%	United States
2	11,5%	Japan
3	7,5%	Germany
4	4,8%	China
5	4,7%	Italy
6	3,0%	France
7	2,8%	Sweden
8	2,6%	South Korea
9	2,2%	Canada
10	2,0%	United Kingdom
11	1,2%	Australia
12	1,2%	Spain
13	0,8%	Iran
14	0,8%	Netherlands
15	0,6%	India
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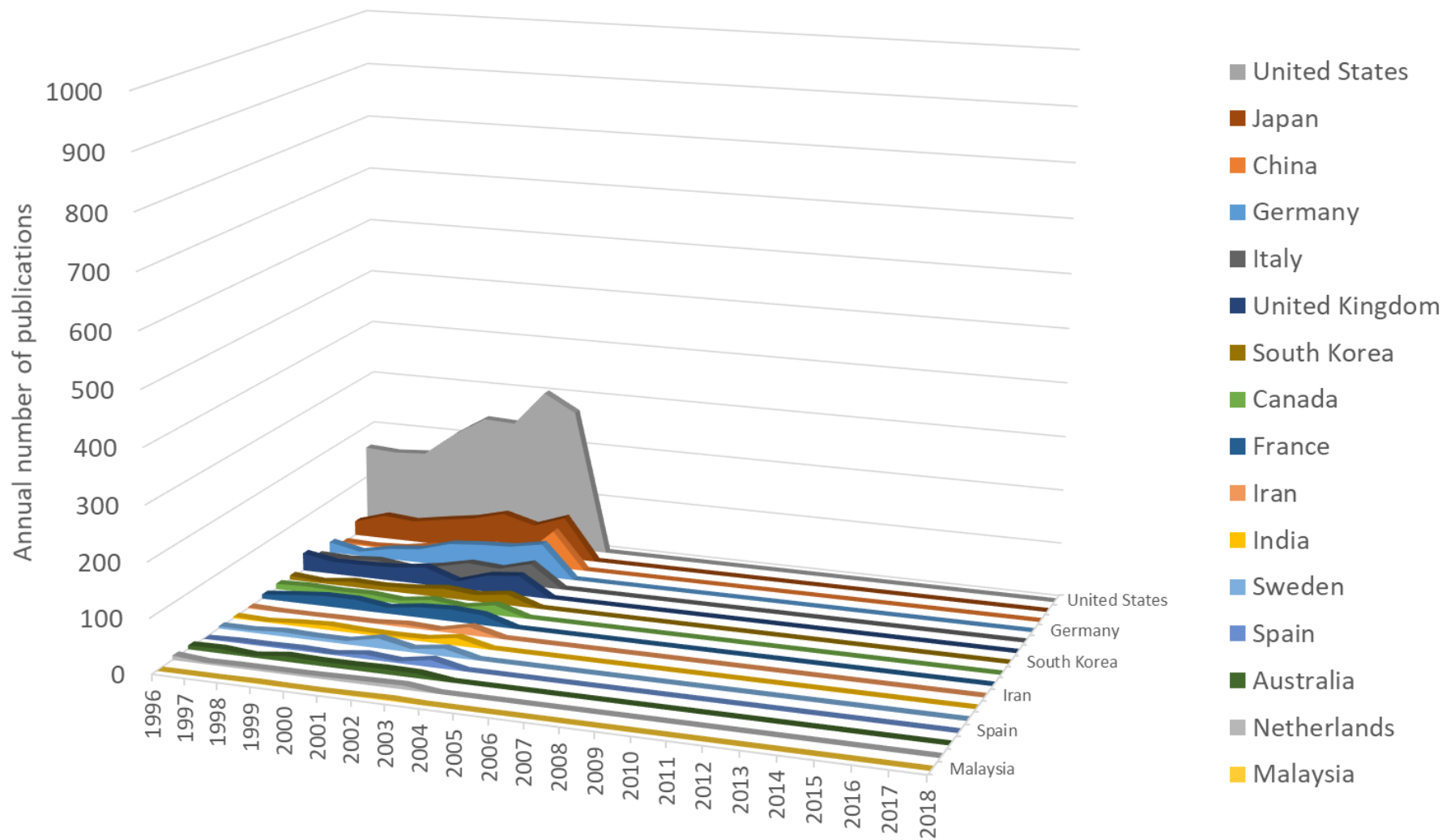
XEV publications top 16 countries (by volume)



2002		
Rank	Share	Country
1	37,8%	United States
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3	6,4%	Germany
4	3,9%	United Kingdom
5	3,3%	Italy
6	2,8%	France
7	2,1%	China
8	1,5%	South Korea
9	1,1%	Australia
10	1,0%	Canada
11	0,8%	Netherlands
12	0,8%	Sweden
13	0,6%	India
14	0,4%	Spain
15	0,3%	Iran
16	0,1%	Malaysia

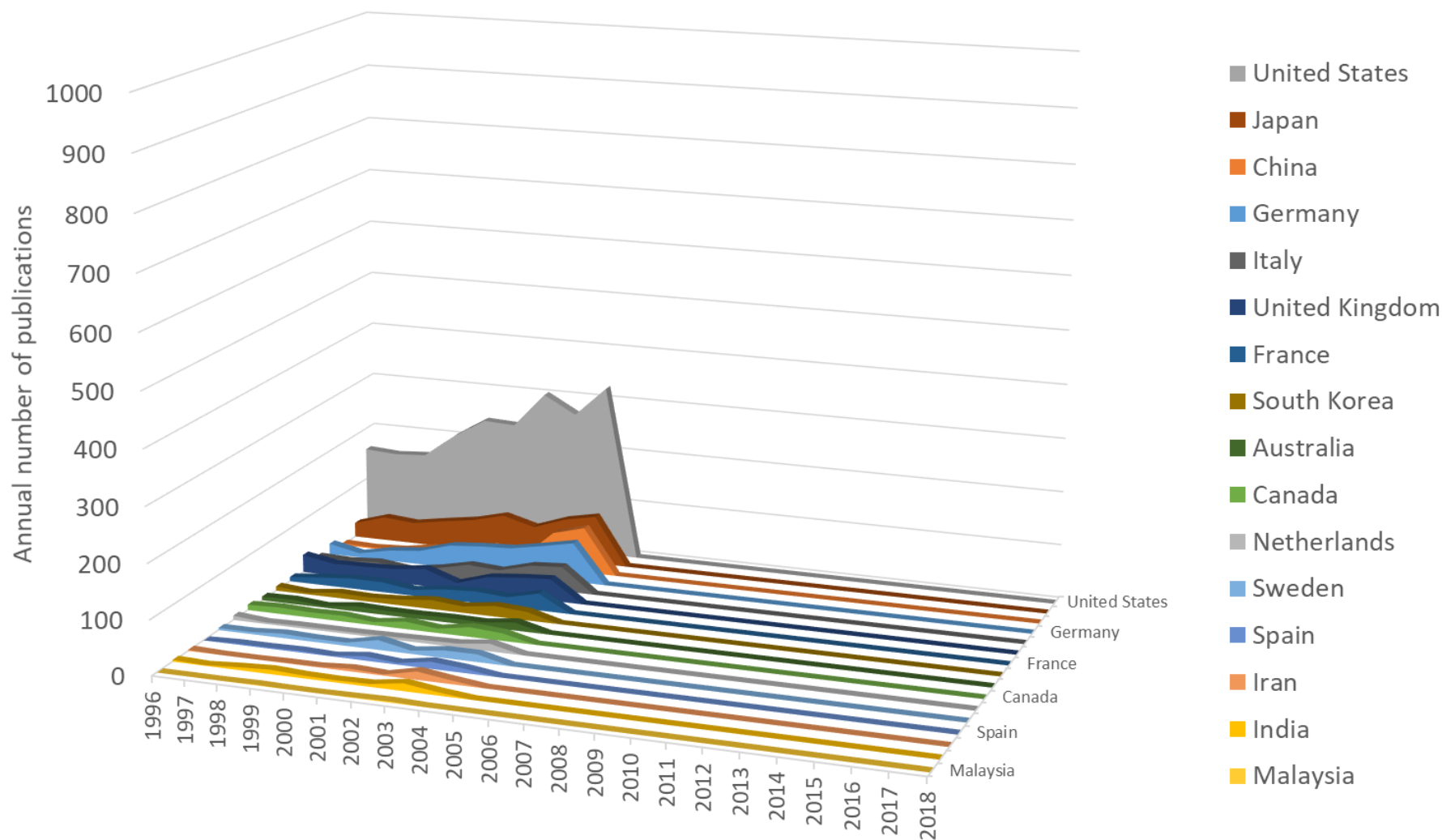
EVS-19 Busan, South
Korea

XEV publications top 16 countries (by volume)



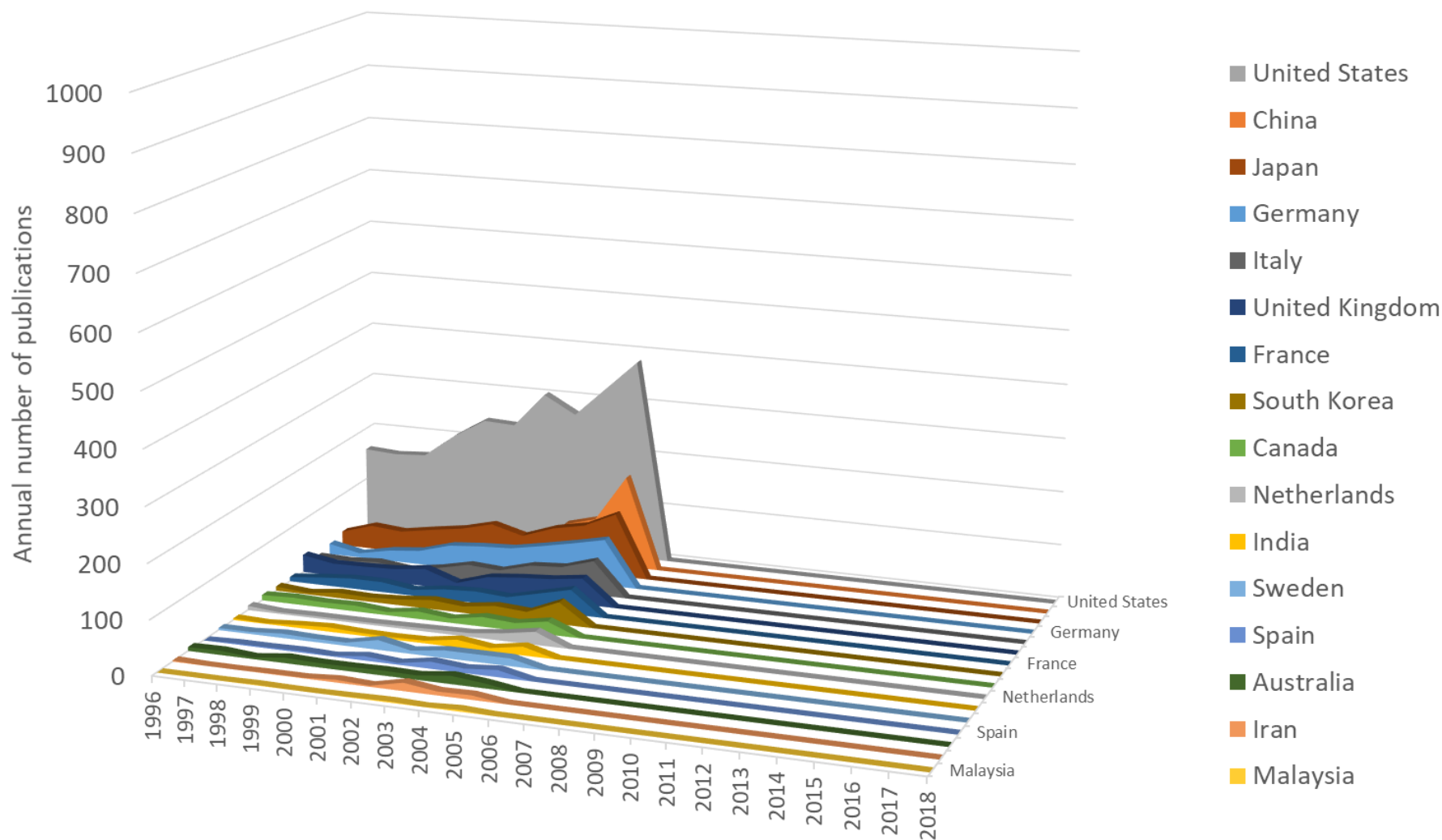
2003		
Rank	Share	Country
1	27,9%	United States
2	8,2%	Japan
3	7,3%	China
4	6,5%	Germany
5	4,4%	Italy
6	3,9%	United Kingdom
7	2,1%	South Korea
8	1,9%	Canada
9	1,9%	France
10	1,6%	Iran
11	1,5%	India
12	1,5%	Sweden
13	1,4%	Spain
14	0,8%	Australia
15	0,7%	Netherlands
16	0,2%	Malaysia

XEV publications top 16 countries (by volume)



2004		
Rank	Share	Country
1	29,9%	United States
2	8,4%	Japan
3	7,9%	China
4	6,8%	Germany
5	4,3%	Italy
6	3,8%	United Kingdom
7	3,0%	France
8	1,5%	South Korea
9	1,4%	Australia
10	1,3%	Canada
11	1,3%	Netherlands
12	1,3%	Sweden
13	0,7%	Spain
14	0,6%	Iran
15	0,6%	India
16	0,0%	Malaysia

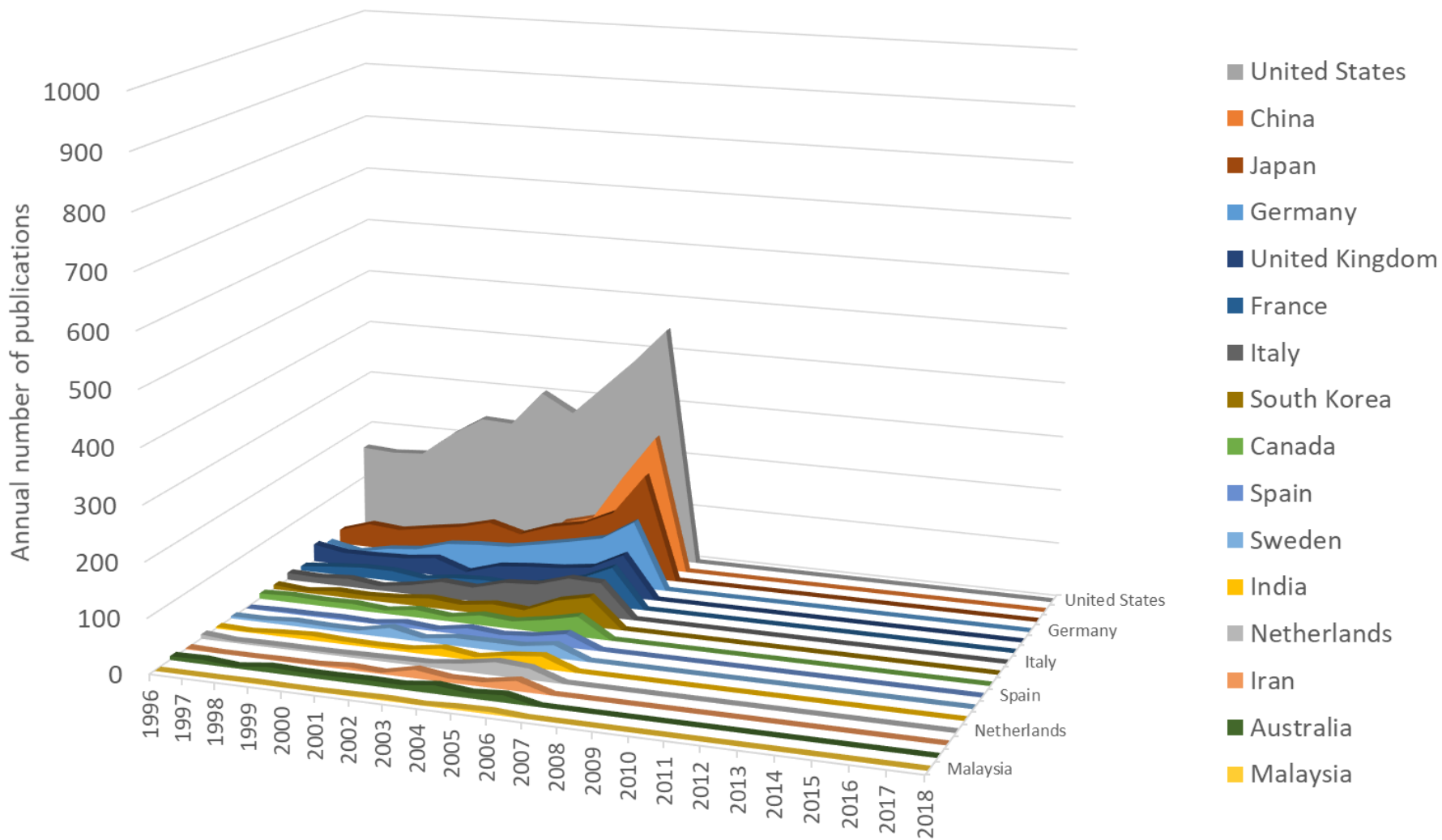
XEV publications top 16 countries (by volume)



2005		
Rank	Share	Country
1	26,7%	United States
2	12,2%	China
3	8,4%	Japan
4	6,1%	Germany
5	4,5%	Italy
6	3,4%	United Kingdom
7	3,2%	France
8	2,9%	South Korea
9	1,7%	Canada
10	1,7%	Netherlands
11	1,1%	India
12	1,0%	Sweden
13	0,9%	Spain
14	0,6%	Australia
15	0,6%	Iran
16	0,2%	Malaysia

EVS-21 Monte-Carlo,
Monaco

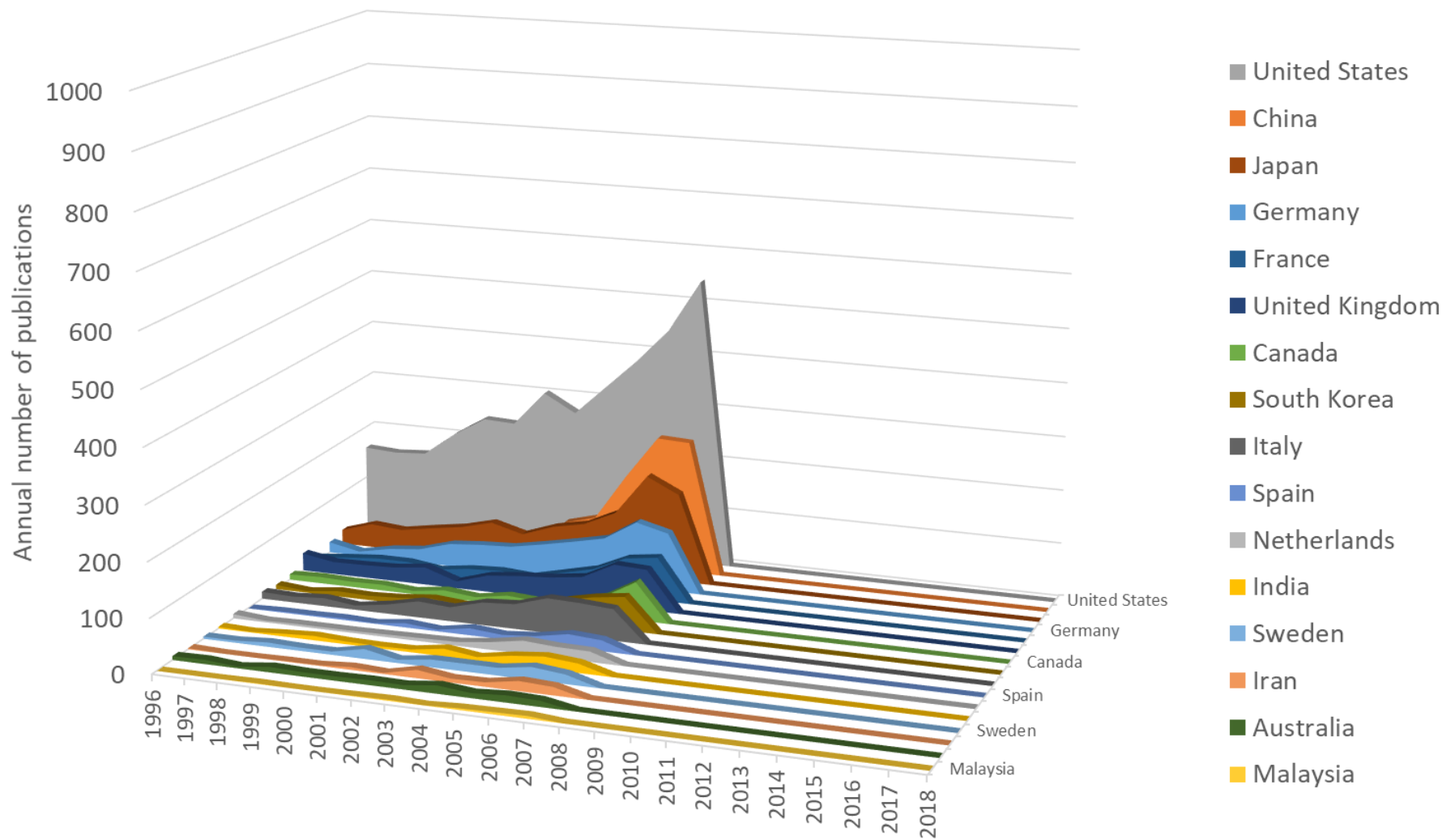
XEV publications top 16 countries (by volume)



2006		
Rank	Share	Country
1	24,8%	United States
2	14,1%	China
3	10,9%	Japan
4	6,9%	Germany
5	4,4%	United Kingdom
6	4,1%	France
7	3,5%	Italy
8	3,0%	South Korea
9	2,1%	Canada
10	1,3%	Spain
11	1,3%	Sweden
12	1,2%	India
13	1,1%	Netherlands
14	1,0%	Iran
15	0,7%	Australia
16	0,2%	Malaysia

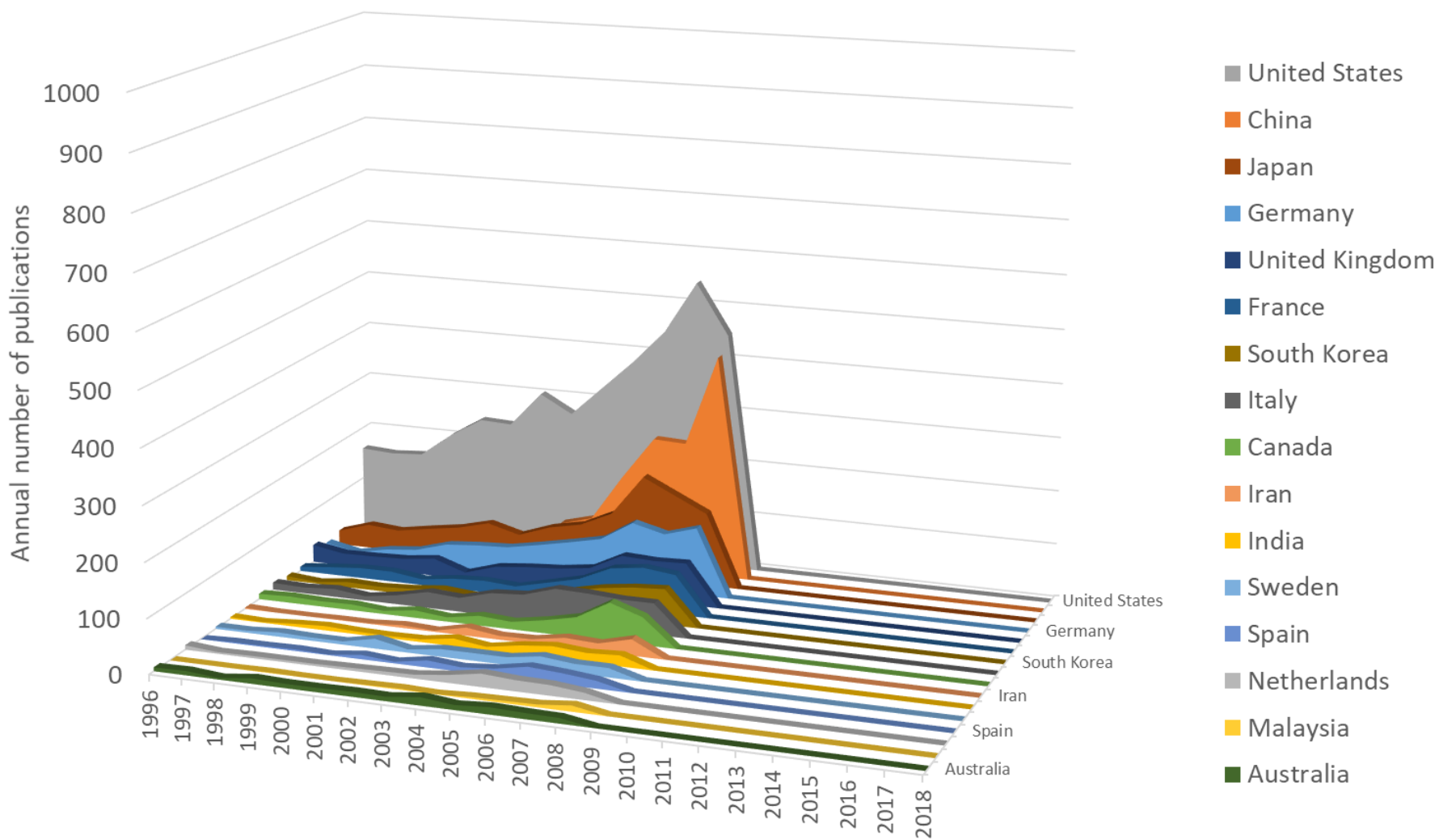
EVS-22 Yokohama, Japan

XEV publications top 16 countries (by volume)



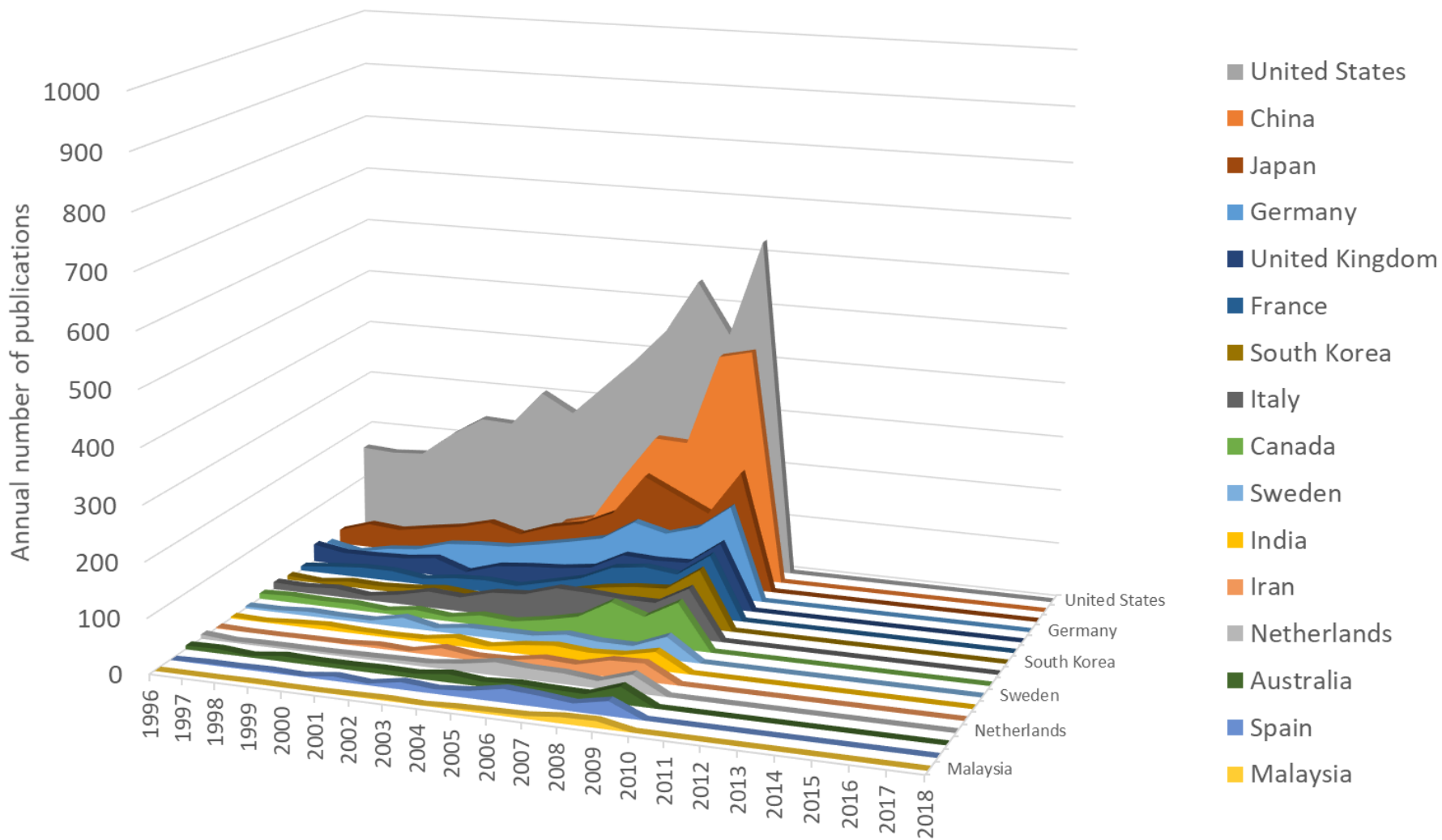
2007		
Rank	Share	Country
1	29,8%	United States
2	13,7%	China
3	9,2%	Japan
4	6,0%	Germany
5	4,5%	France
6	4,2%	United Kingdom
7	3,9%	Canada
8	3,4%	South Korea
9	3,2%	Italy
10	1,1%	Spain
11	1,0%	Netherlands
12	0,9%	India
13	0,9%	Sweden
14	0,8%	Iran
15	0,6%	Australia
16	0,3%	Malaysia

XEV publications top 16 countries (by volume)



2008		
Rank	Share	Country
1	23,8%	United States
2	22,3%	China
3	7,3%	Japan
4	6,8%	Germany
5	4,2%	United Kingdom
6	3,9%	France
7	3,5%	South Korea
8	3,1%	Italy
9	2,7%	Canada
10	1,6%	Iran
11	1,1%	India
12	0,9%	Sweden
13	0,7%	Spain
14	0,7%	Netherlands
15	0,6%	Malaysia
16	0,5%	Australia

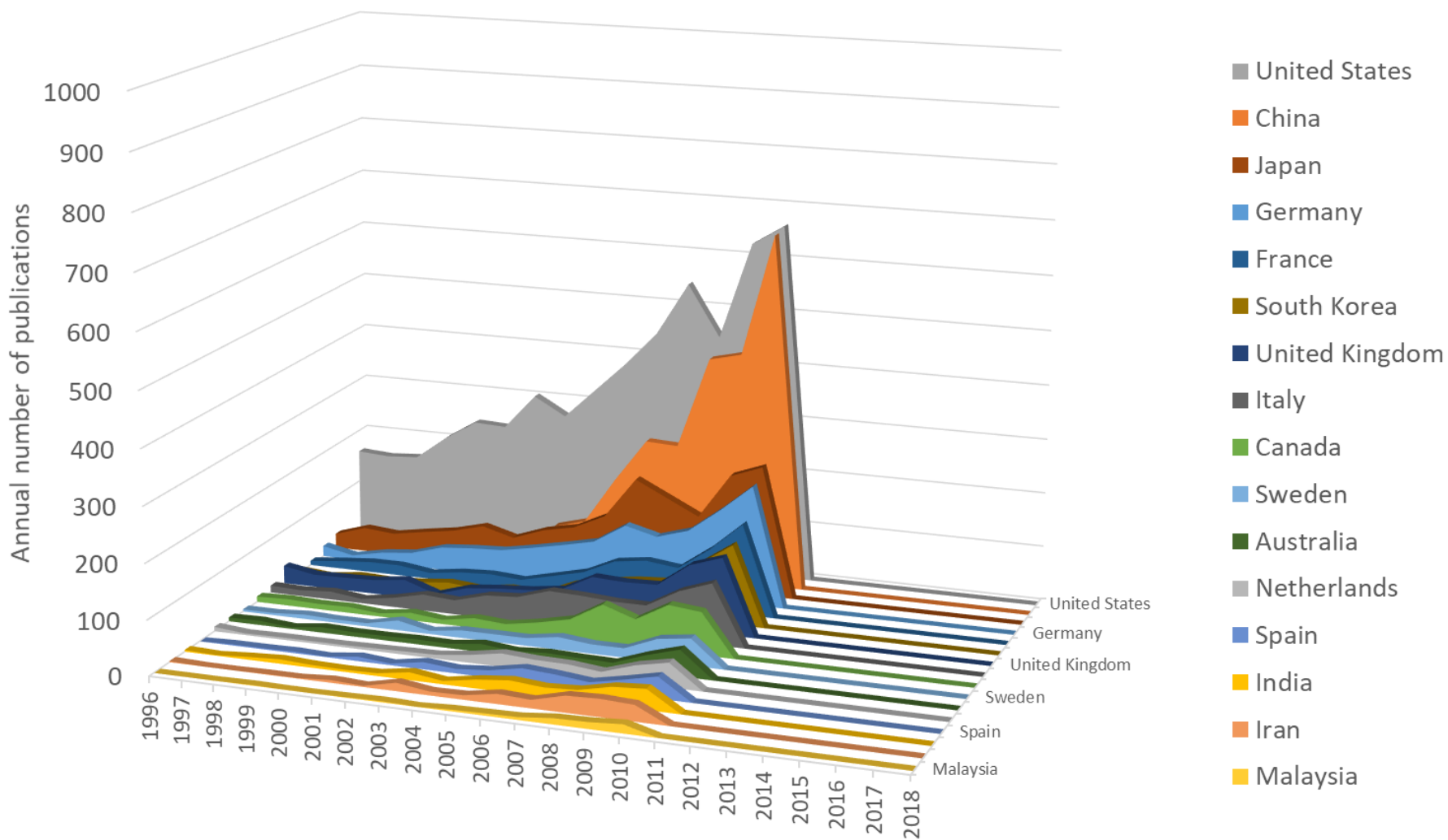
XEV publications top 16 countries (by volume)



2009		
Rank	Share	Country
1	23,7%	United States
2	16,4%	China
3	8,3%	Japan
4	6,5%	Germany
5	4,6%	United Kingdom
6	4,4%	France
7	4,1%	South Korea
8	3,5%	Italy
9	3,2%	Canada
10	1,6%	Sweden
11	1,3%	India
12	1,2%	Iran
13	1,2%	Netherlands
14	1,2%	Australia
15	1,0%	Spain
16	0,5%	Malaysia

EVS-24 Stavanger,
Norway

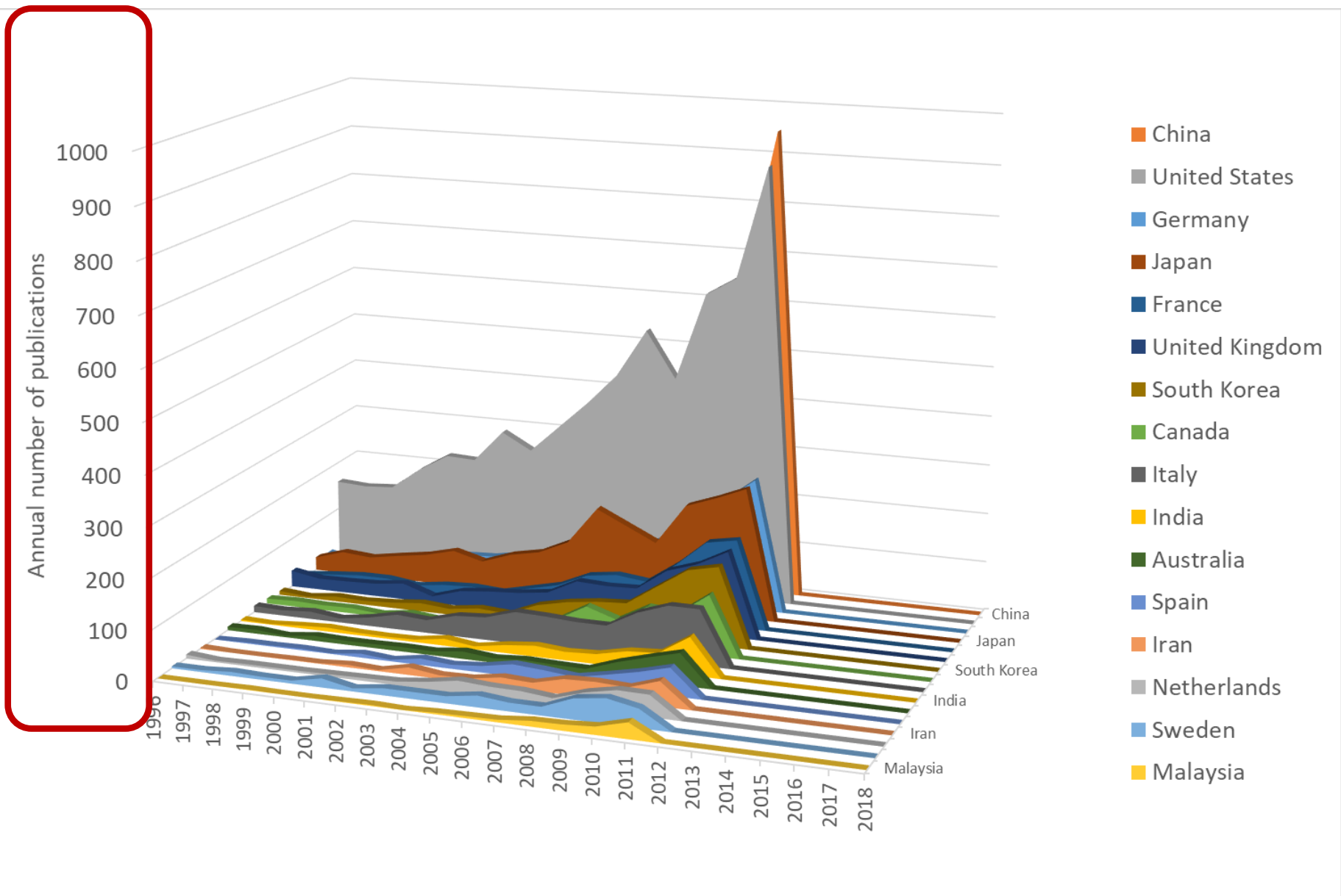
XEV publications top 16 countries (by volume)



2010		
Rank	Share	Country
1	20,0%	United States
2	19,8%	China
3	7,3%	Japan
4	6,7%	Germany
5	5,1%	France
6	4,4%	South Korea
7	4,3%	United Kingdom
8	3,4%	Italy
9	2,4%	Canada
10	1,5%	Sweden
11	1,5%	Australia
12	1,3%	Netherlands
13	1,2%	Spain
14	1,1%	India
15	0,9%	Iran
16	0,5%	Malaysia

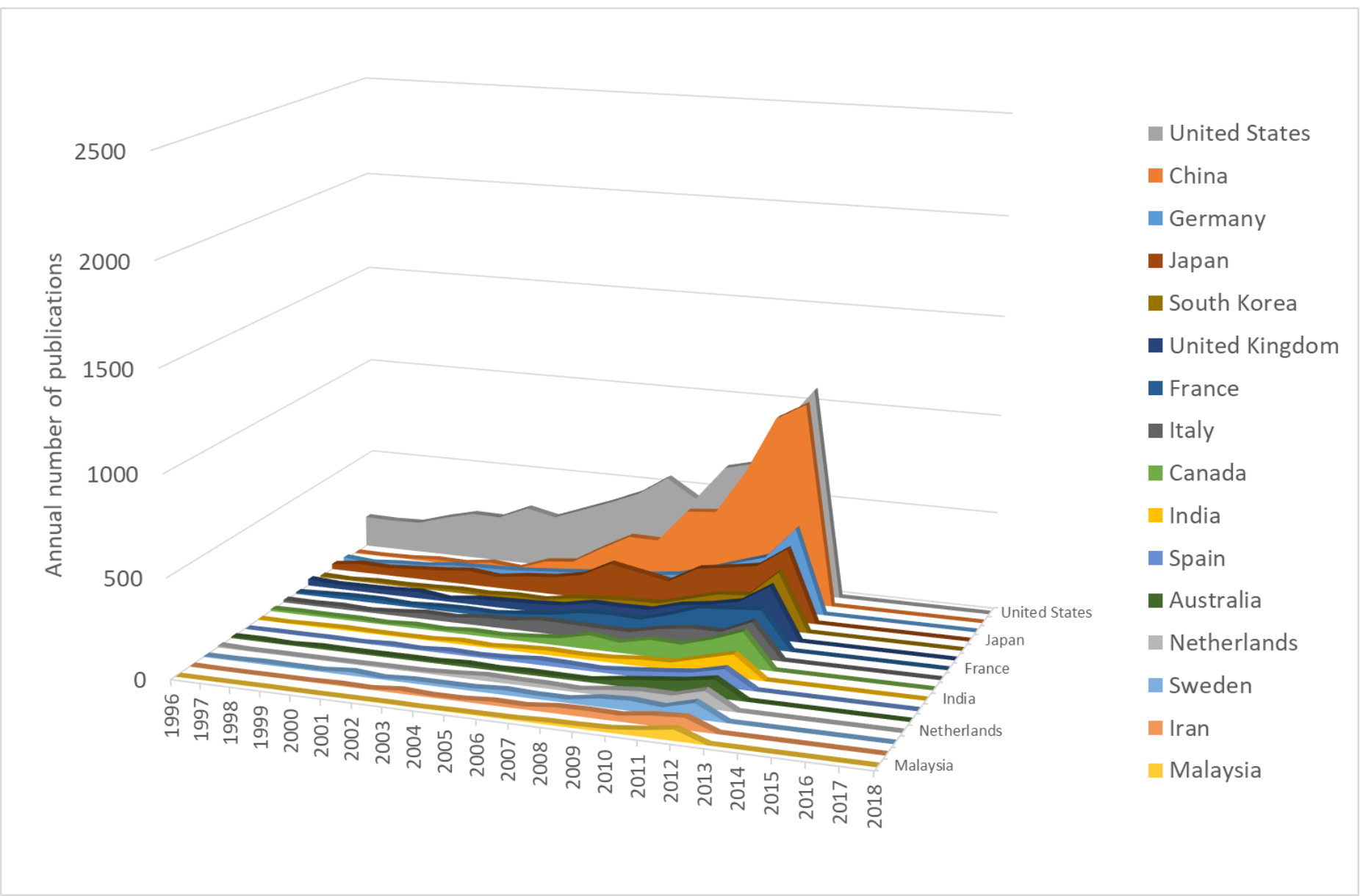
EVS-25 Shenzhen, China

XEV publications top 16 countries (by volume)



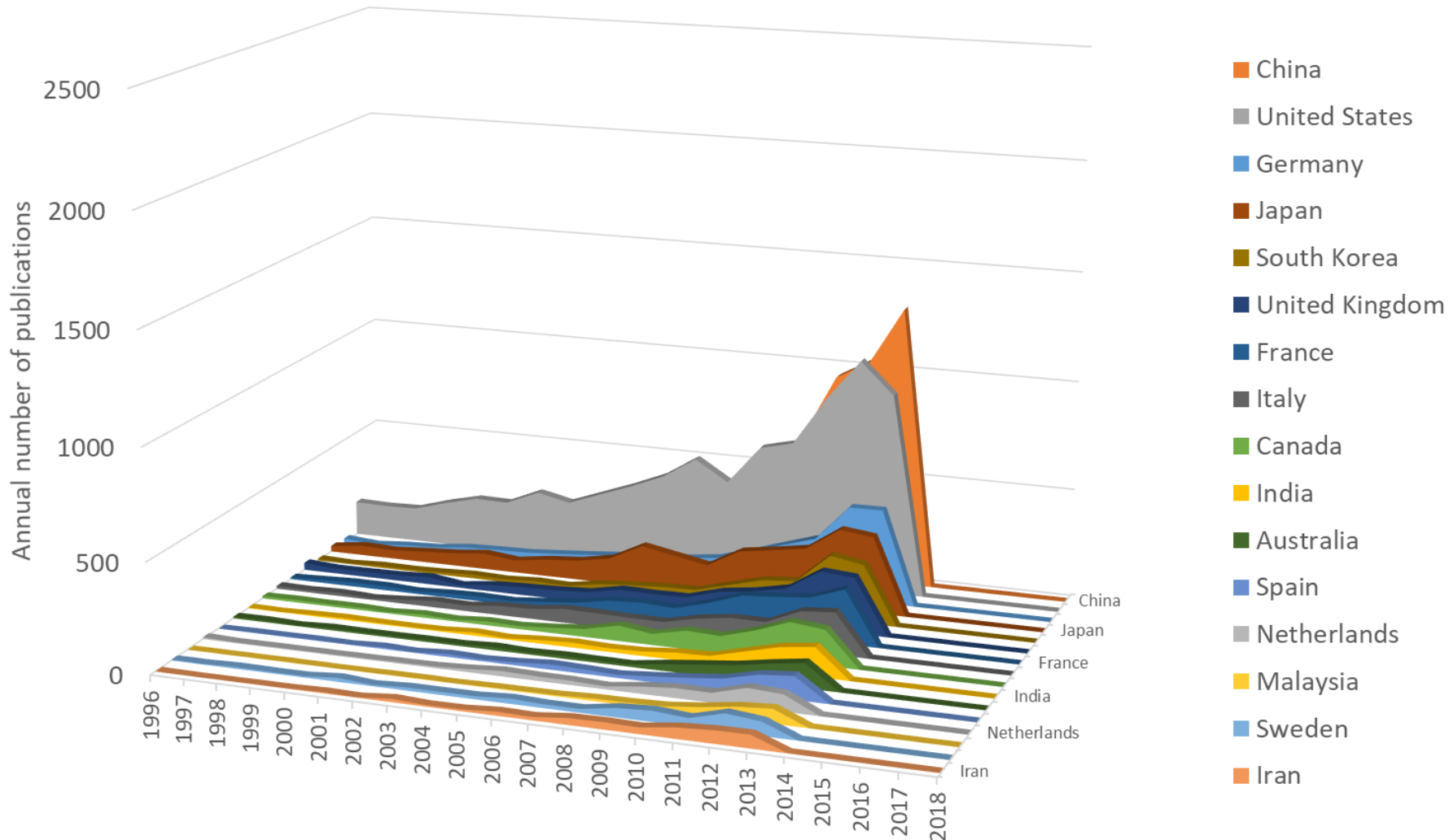
2011		
Rank	Share	Country
1	23,4%	China
2	21,9%	United States
3	6,6%	Germany
4	6,6%	Japan
5	4,4%	France
6	4,3%	United Kingdom
7	3,9%	South Korea
8	3,0%	Canada
9	2,8%	Italy
10	1,9%	India
11	1,6%	Australia
12	1,4%	Spain
13	1,2%	Iran
14	1,1%	Netherlands
15	0,9%	Sweden
16	0,8%	Malaysia

XEV publications top 16 countries (by volume)



2012		
Rank	Share	Country
1	20,1%	United States
2	19,4%	China
3	8,1%	Germany
4	7,0%	Japan
5	5,5%	South Korea
6	5,0%	United Kingdom
7	3,6%	France
8	3,4%	Italy
9	3,3%	Canada
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11	1,7%	Spain
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14	1,4%	Sweden
15	1,1%	Iran
16	1,0%	Malaysia

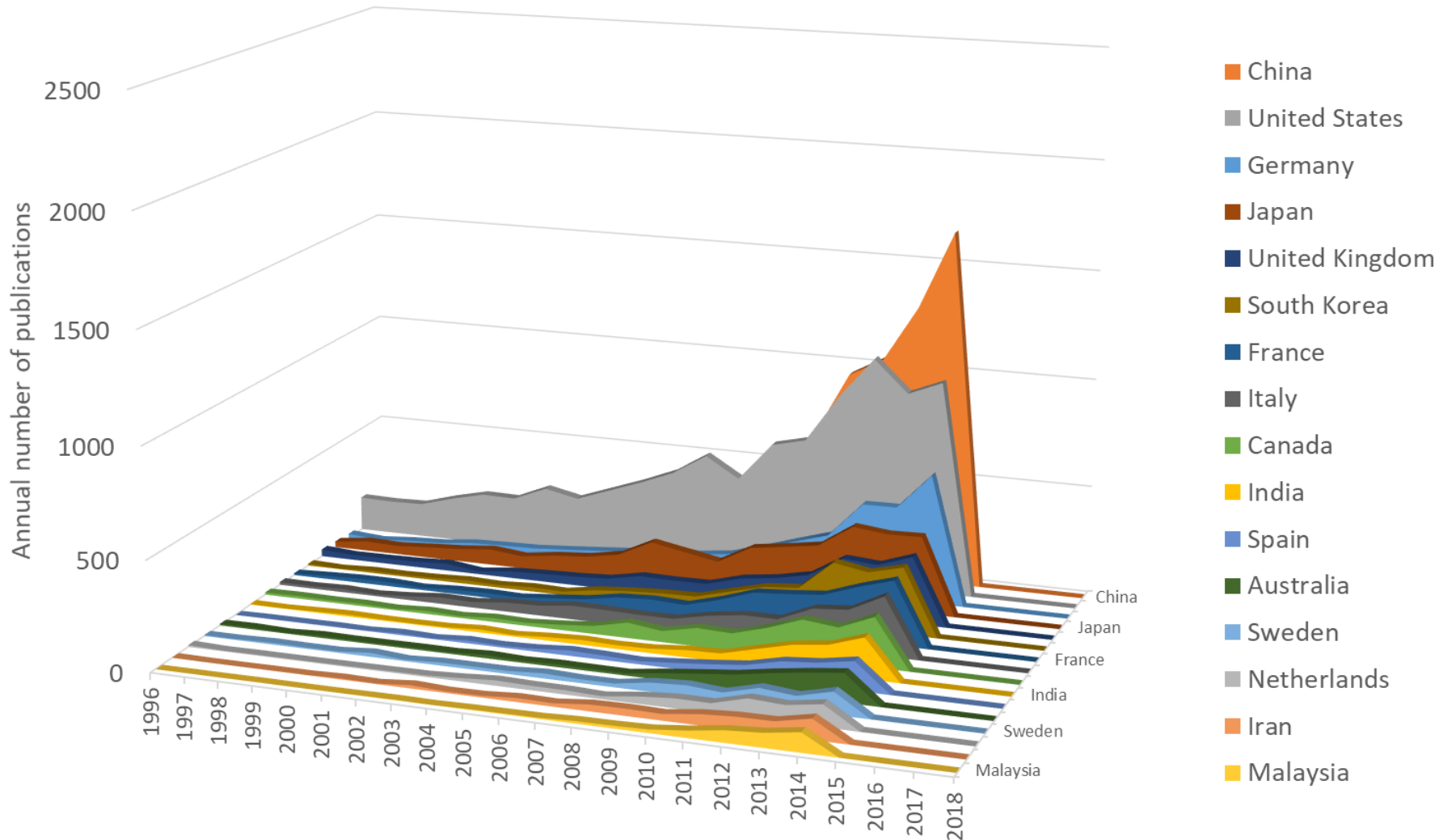
XEV publications top 16 countries (by volume)



2013		
Rank	Share	Country
1	23,7%	China
2	17,1%	United States
3	8,0%	Germany
4	6,5%	Japan
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6	4,7%	United Kingdom
7	4,6%	France
8	3,5%	Italy
9	3,0%	Canada
10	2,5%	India
11	2,1%	Australia
12	1,9%	Spain
13	1,4%	Netherlands
14	1,2%	Malaysia
15	1,1%	Sweden
16	1,1%	Iran

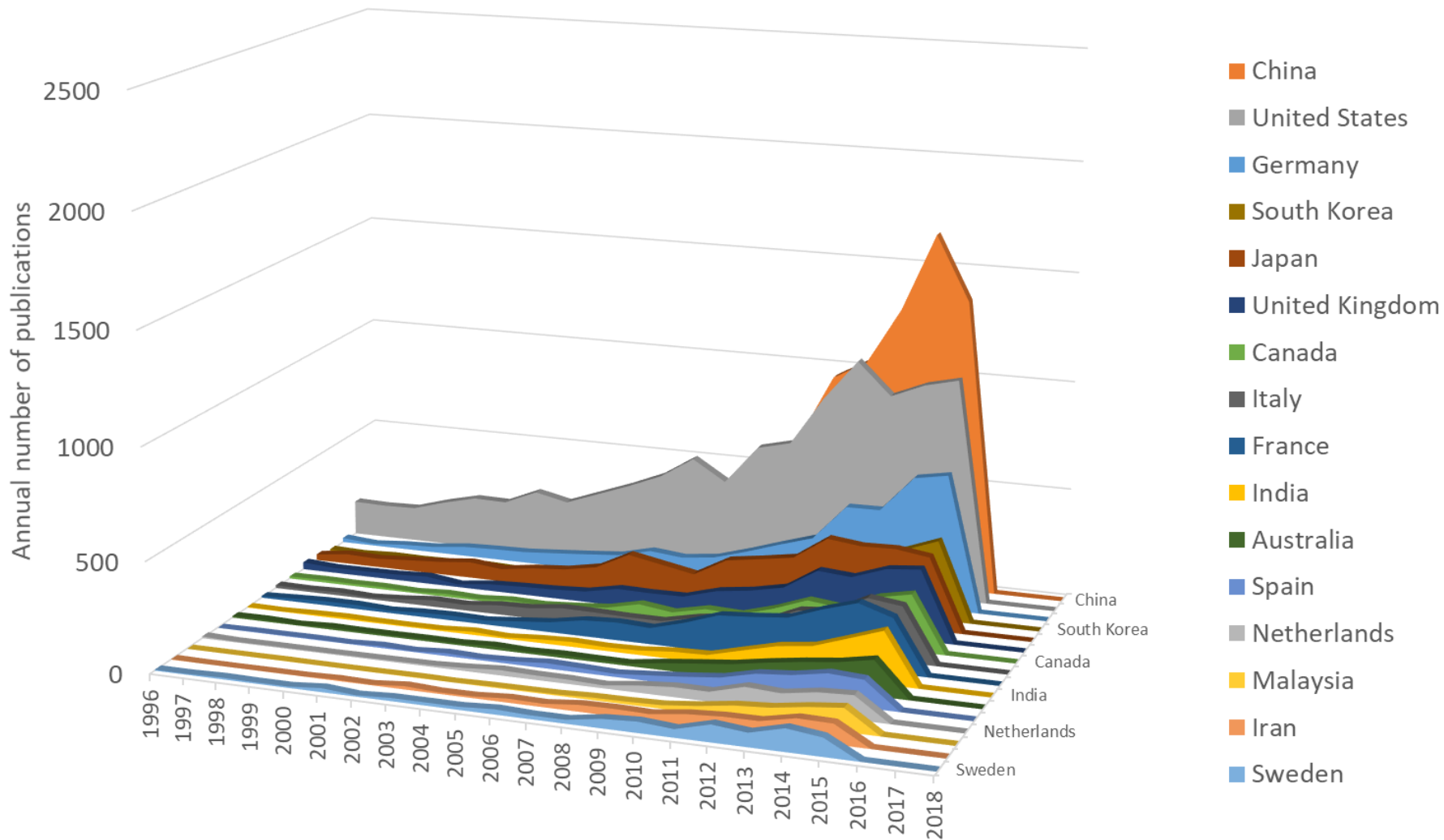
EVS-27 Barcelona, Spain

XEV publications top 16 countries (by volume)



2014		
Rank	Share	Country
1	25,0%	China
2	15,0%	United States
3	9,1%	Germany
4	5,4%	Japan
5	4,7%	United Kingdom
6	4,7%	South Korea
7	4,5%	France
8	4,1%	Italy
9	3,5%	Canada
10	2,8%	India
11	2,0%	Spain
12	2,0%	Australia
13	1,5%	Sweden
14	1,5%	Netherlands
15	1,4%	Iran
16	1,3%	Malaysia

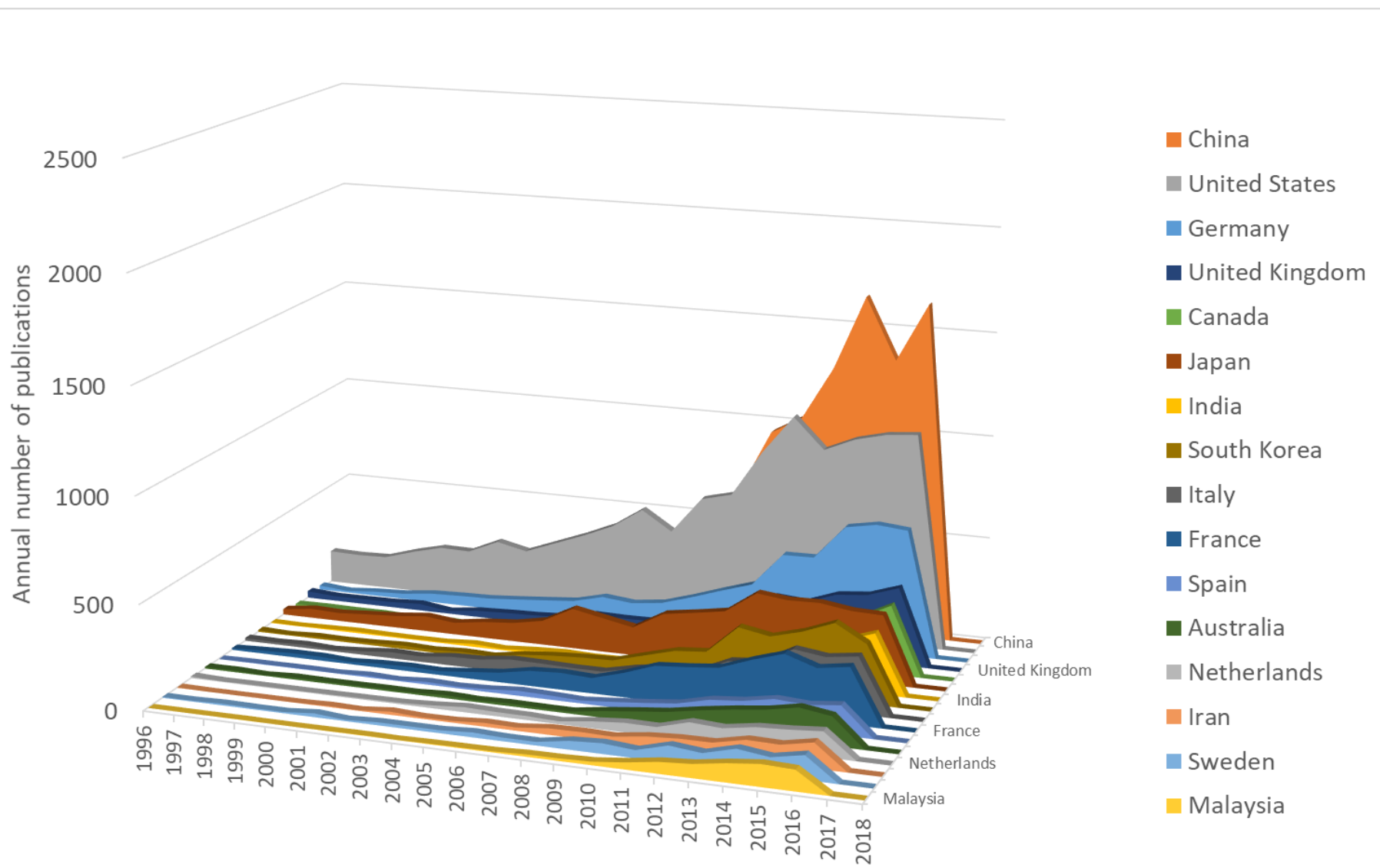
XEV publications top 16 countries (by volume)



2015		
Rank	Share	Country
1	21,7%	China
2	16,5%	United States
3	10,1%	Germany
4	5,9%	South Korea
5	5,4%	Japan
6	5,2%	United Kingdom
7	4,2%	Canada
8	4,0%	Italy
9	4,0%	France
10	3,8%	India
11	2,6%	Australia
12	2,0%	Spain
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14	1,7%	Malaysia
15	1,4%	Iran
16	1,3%	Sweden

EVS-28 Goyang, South Korea

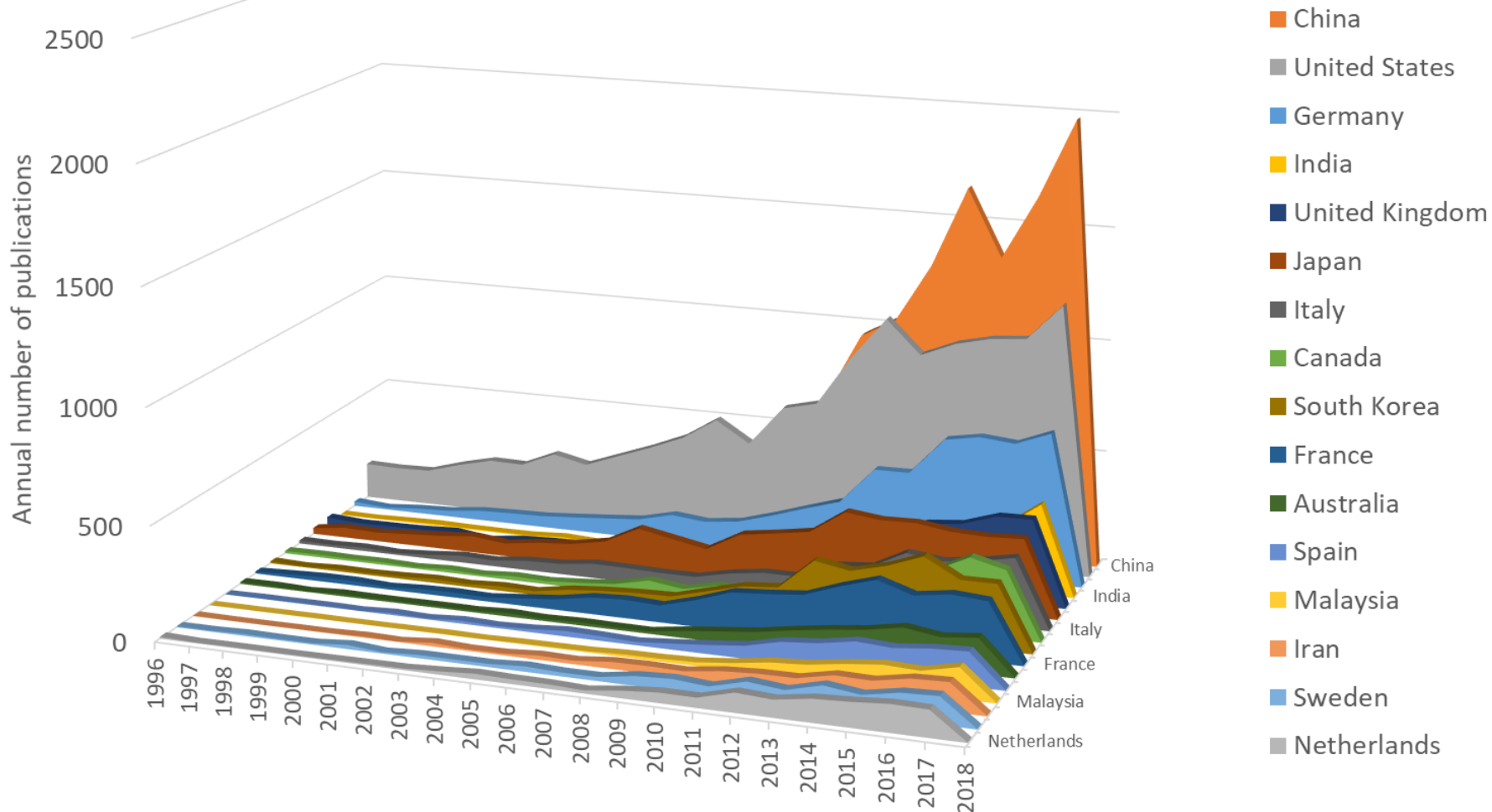
XEV publications top 16 countries (by volume)



2016		
Rank	Share	Country
1	24,7%	China
2	15,7%	United States
3	9,3%	Germany
4	5,7%	United Kingdom
5	5,0%	Canada
6	5,0%	Japan
7	4,4%	India
8	4,3%	South Korea
9	4,1%	Italy
10	4,1%	France
11	2,1%	Spain
12	2,1%	Australia
13	1,8%	Netherlands
14	1,8%	Iran
15	1,7%	Sweden
16	1,5%	Malaysia

EVS-29 Montréal,
Canada

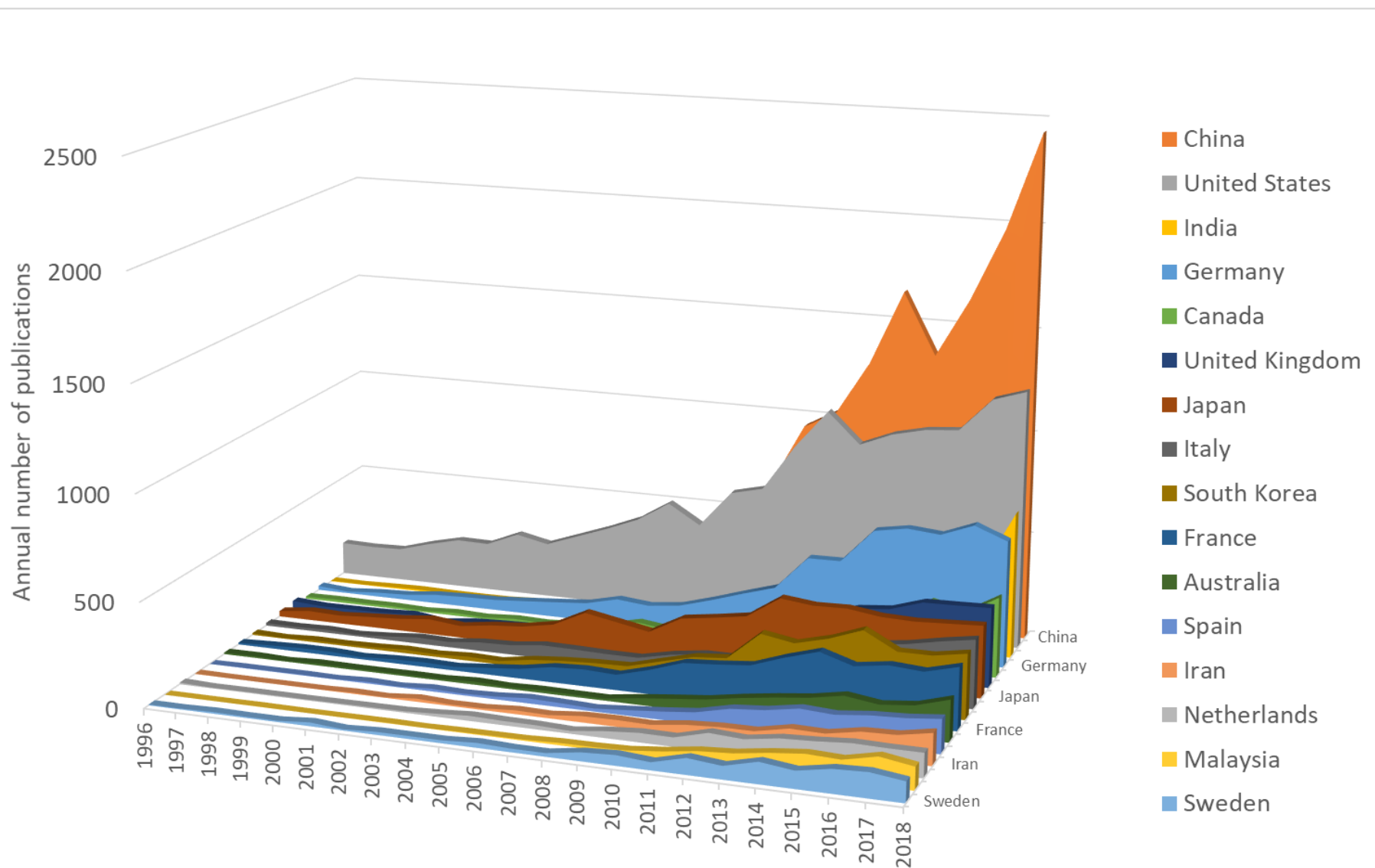
XEV publications top 16 countries (by volume)



2017		
Rank	Share	Country
1	27,0%	China
2	16,4%	United States
3	9,2%	Germany
4	5,5%	India
5	5,2%	United Kingdom
6	4,6%	Japan
7	4,1%	Italy
8	4,0%	Canada
9	3,9%	South Korea
10	3,5%	France
11	2,1%	Australia
12	2,0%	Spain
13	1,8%	Malaysia
14	1,7%	Iran
15	1,6%	Sweden
16	1,6%	Netherlands

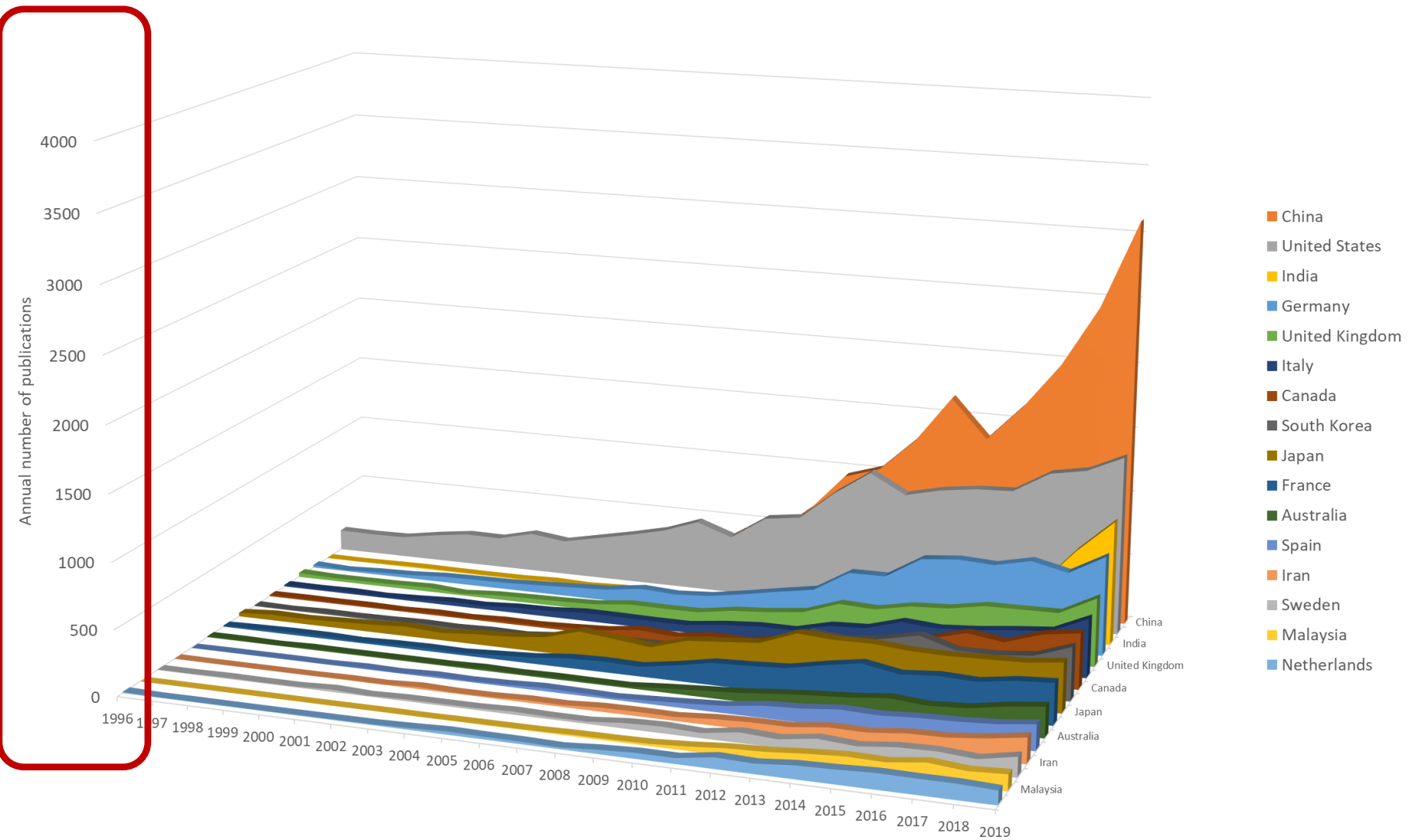
EVS-30 Stuttgart,
Germany

XEV publications top 16 countries (by volume)



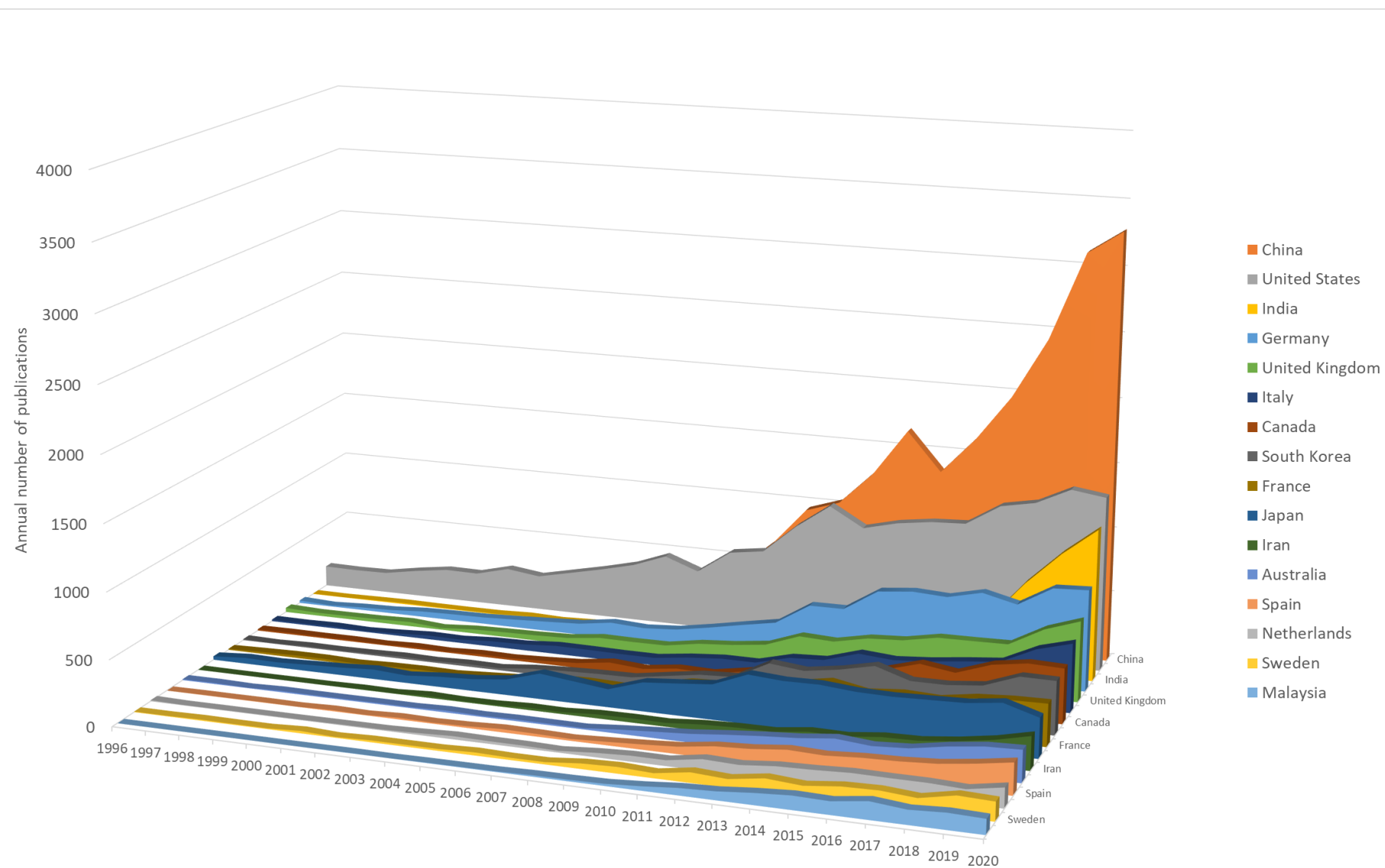
2018		
Rank	Share	Country
1	29,0%	China
2	14,9%	United States
3	8,3%	India
4	7,3%	Germany
5	4,6%	Canada
6	4,6%	United Kingdom
7	4,1%	Japan
8	3,9%	Italy
9	3,7%	South Korea
10	3,6%	France
11	2,4%	Australia
12	1,9%	Spain
13	1,8%	Iran
14	1,4%	Netherlands
15	1,3%	Malaysia
16	1,2%	Sweden

XEV publications top 16 countries (by volume)



2019		
Rank	Share	Country
1	30.0%	China
2	13.3%	United States
3	9.2%	India
4	7.4%	Germany
5	5.1%	United Kingdom
6	4.4%	Italy
7	4.1%	Canada
8	3.9%	South Korea
9	3.7%	Japan
10	3.1%	France
11	2.2%	Australia
12	1.9%	Spain
13	1.9%	Iran
14	1.4%	Sweden
15	1.2%	Malaysia
16	1.0%	Netherlands

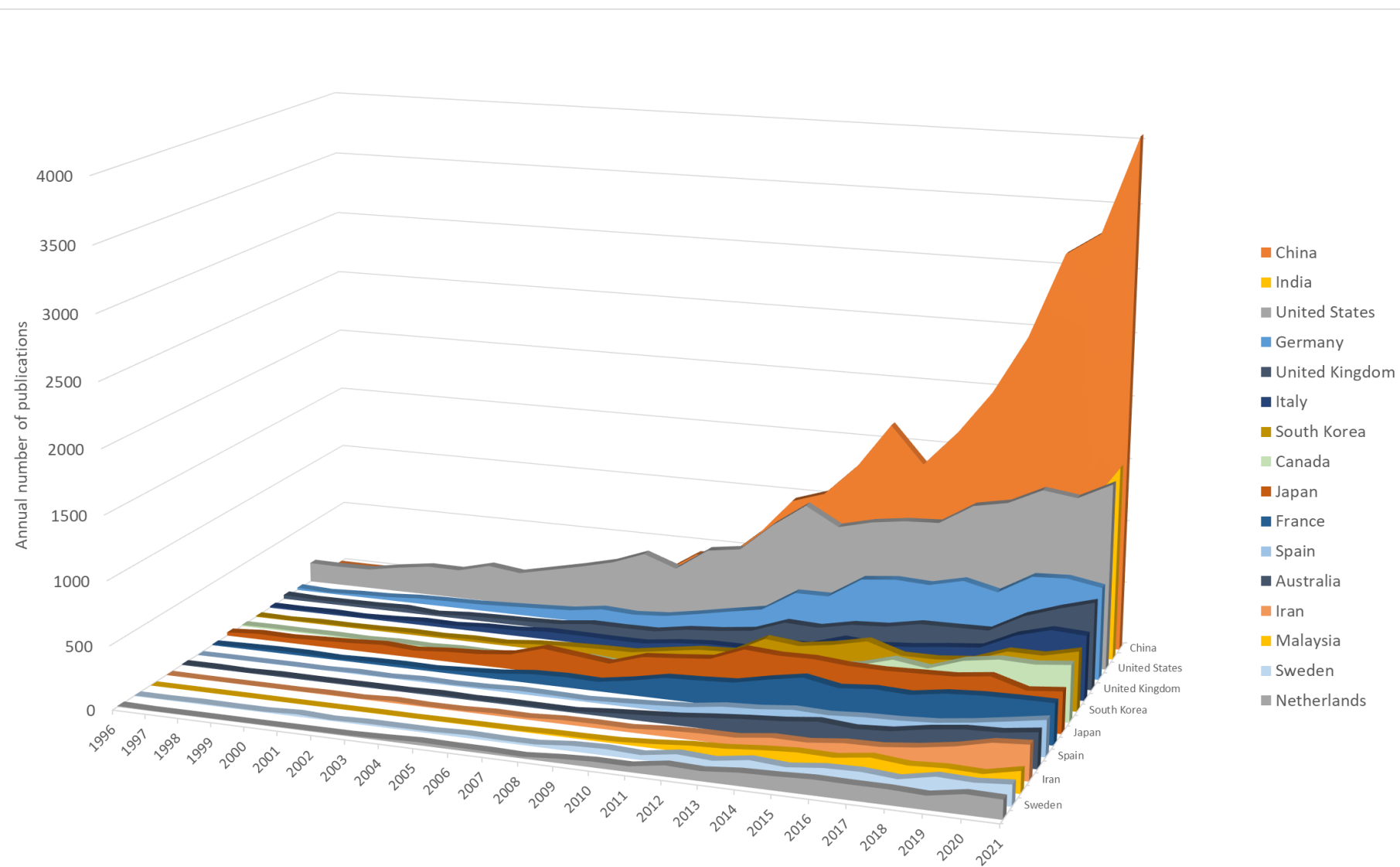
XEV publications top 16 countries (by volume)



2020		
Rank	Share	Country
1	30.3%	China
2	12.4%	United States
3	10.7%	India
4	7.2%	Germany
5	5.7%	United Kingdom
6	4.8%	Italy
7	3.9%	Canada
8	3.7%	South Korea
9	3.0%	France
10	2.8%	Japan
11	2.3%	Iran
12	2.2%	Australia
13	2.2%	Spain
14	1.4%	Netherlands
15	1.3%	Sweden
16	1.0%	Malaysia

(EVS-33 Portland, USA)

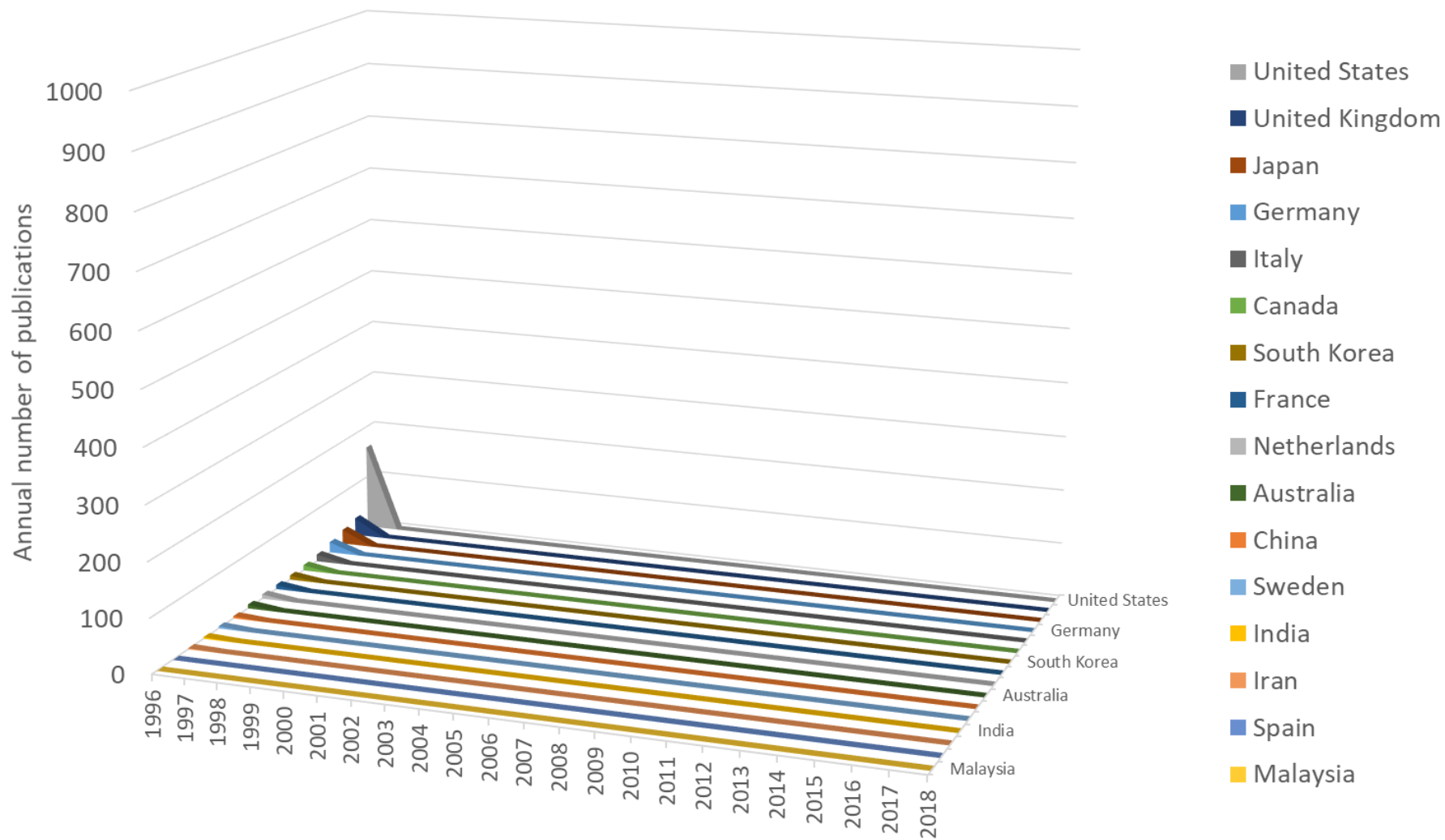
XEV publications top 16 countries (by volume)



2021		
Rank	Share	Country
1	31.9%	China
2	12.1%	India
3	11.6%	United States
4	5.8%	Germany
5	5.4%	United Kingdom
6	4.0%	Italy
7	3.7%	South Korea
8	3.5%	Canada
9	2.6%	Japan
10	2.5%	France
11	2.2%	Spain
12	2.2%	Australia
13	2.2%	Iran
14	1.3%	Malaysia
15	1.3%	Sweden
16	1.1%	Netherlands

(EVS-34 Nanjing, China)

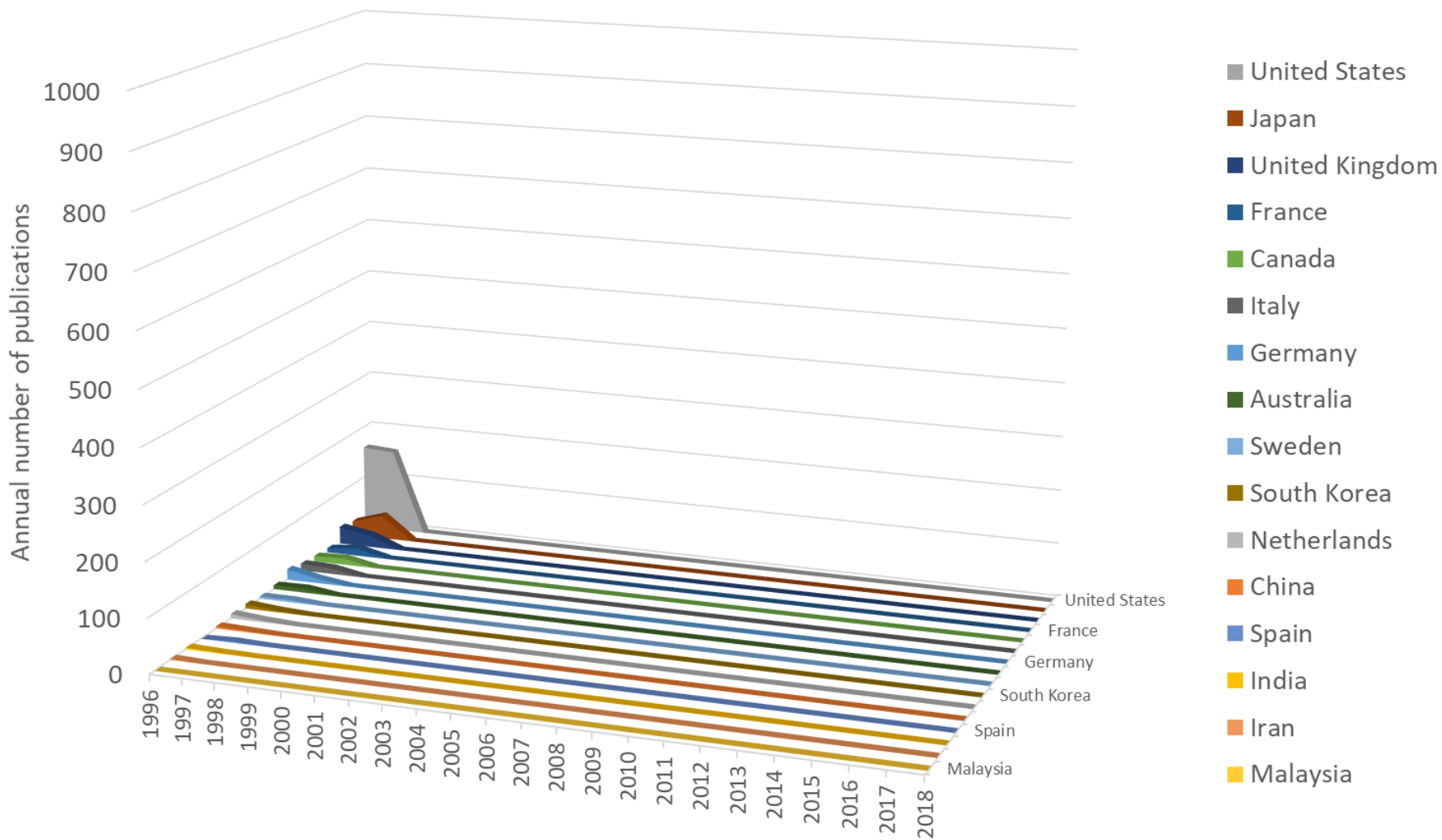
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8	2,0%	France
9	2,0%	Netherlands
10	1,8%	Australia
11	1,0%	China
12	1,0%	Sweden
13	0,8%	India
14	0,5%	Iran
15	0,0%	Spain
16	0,0%	Malaysia

EVS-13 Osaka, Japan

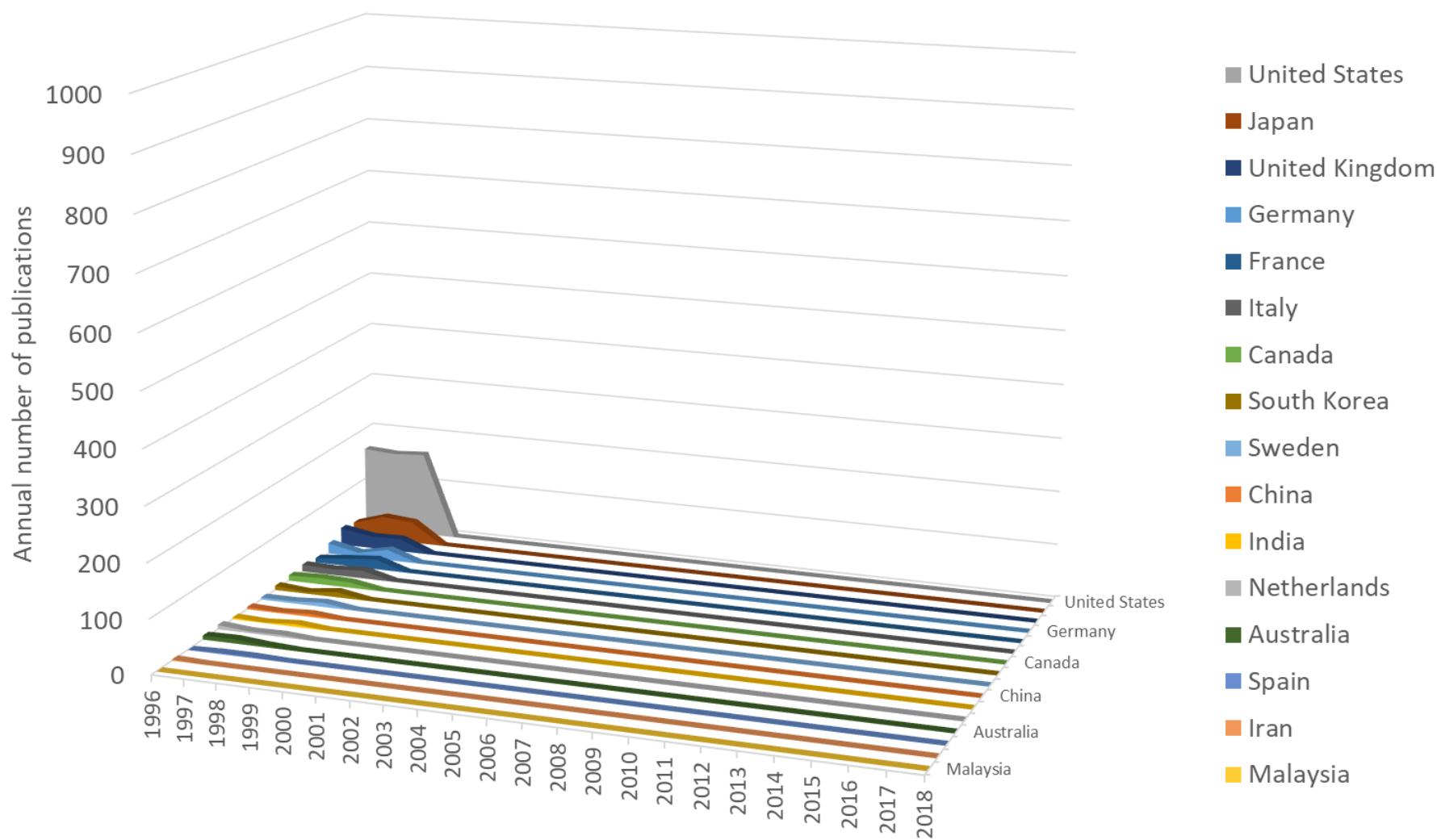
XEV publications top 16 countries (by volume)



1997		
Rank	Share	Country
1	40,4%	United States
2	11,7%	Japan
3	6,0%	United Kingdom
4	3,6%	France
5	3,1%	Canada
6	2,9%	Italy
7	2,1%	Germany
8	2,1%	Australia
9	1,0%	Sweden
10	0,8%	South Korea
11	0,8%	Netherlands
12	0,5%	China
13	0,5%	Spain
14	0,3%	India
15	0,0%	Iran
16	0,0%	Malaysia

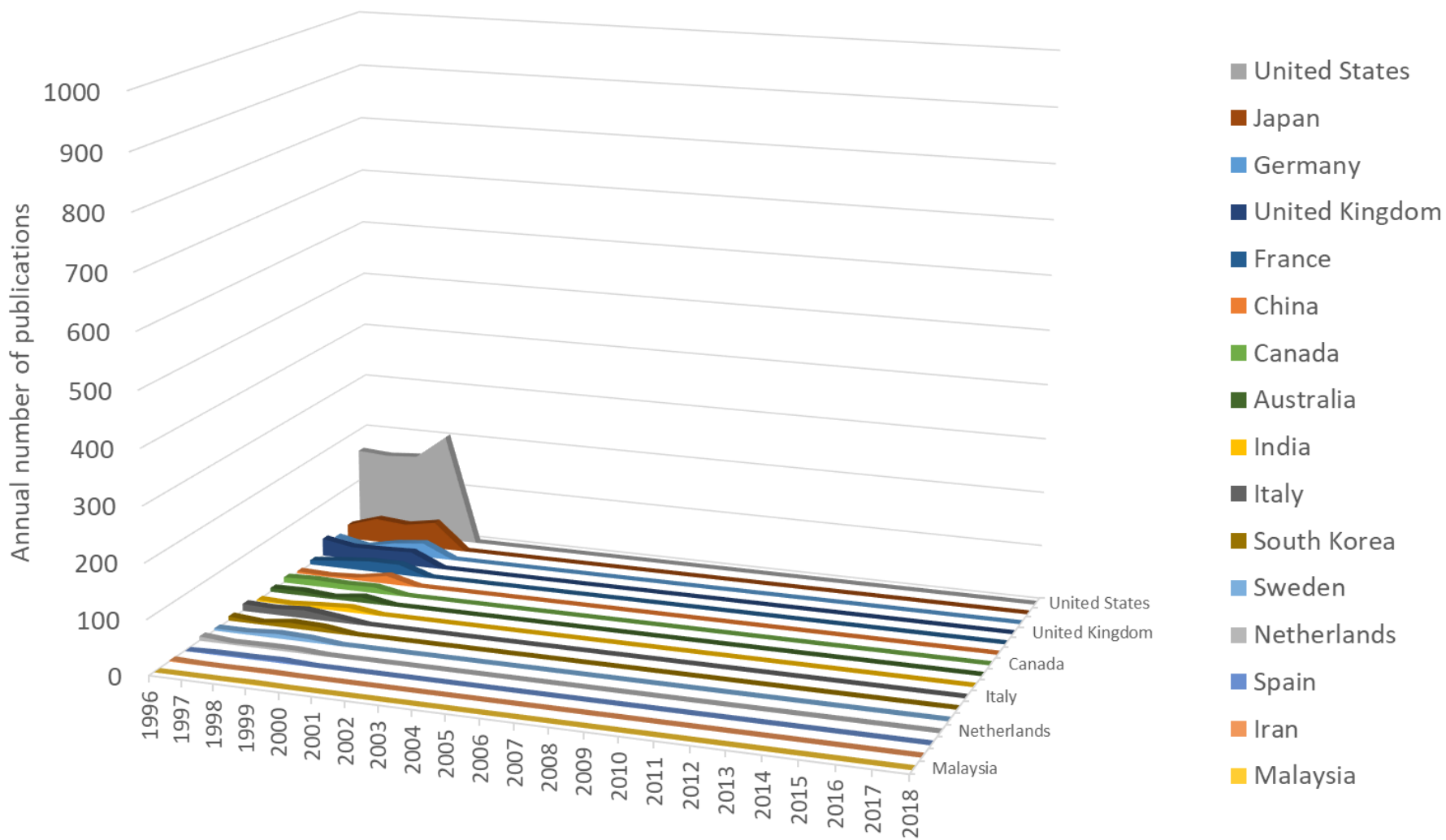
EVS-14 Orlando, USA

XEV publications top 16 countries (by volume)



1998		
Rank	Share	Country
1	41.1%	United States
2	10.3%	Japan
3	6.2%	United Kingdom
4	5.2%	Germany
5	4.9%	France
6	3.9%	Italy
7	2.6%	Canada
8	2.6%	South Korea
9	2.1%	Sweden
10	1.3%	China
11	1.3%	India
12	1.0%	Netherlands
13	0.8%	Australia
14	0.5%	Spain
15	0.0%	Iran
16	0.0%	Malaysia

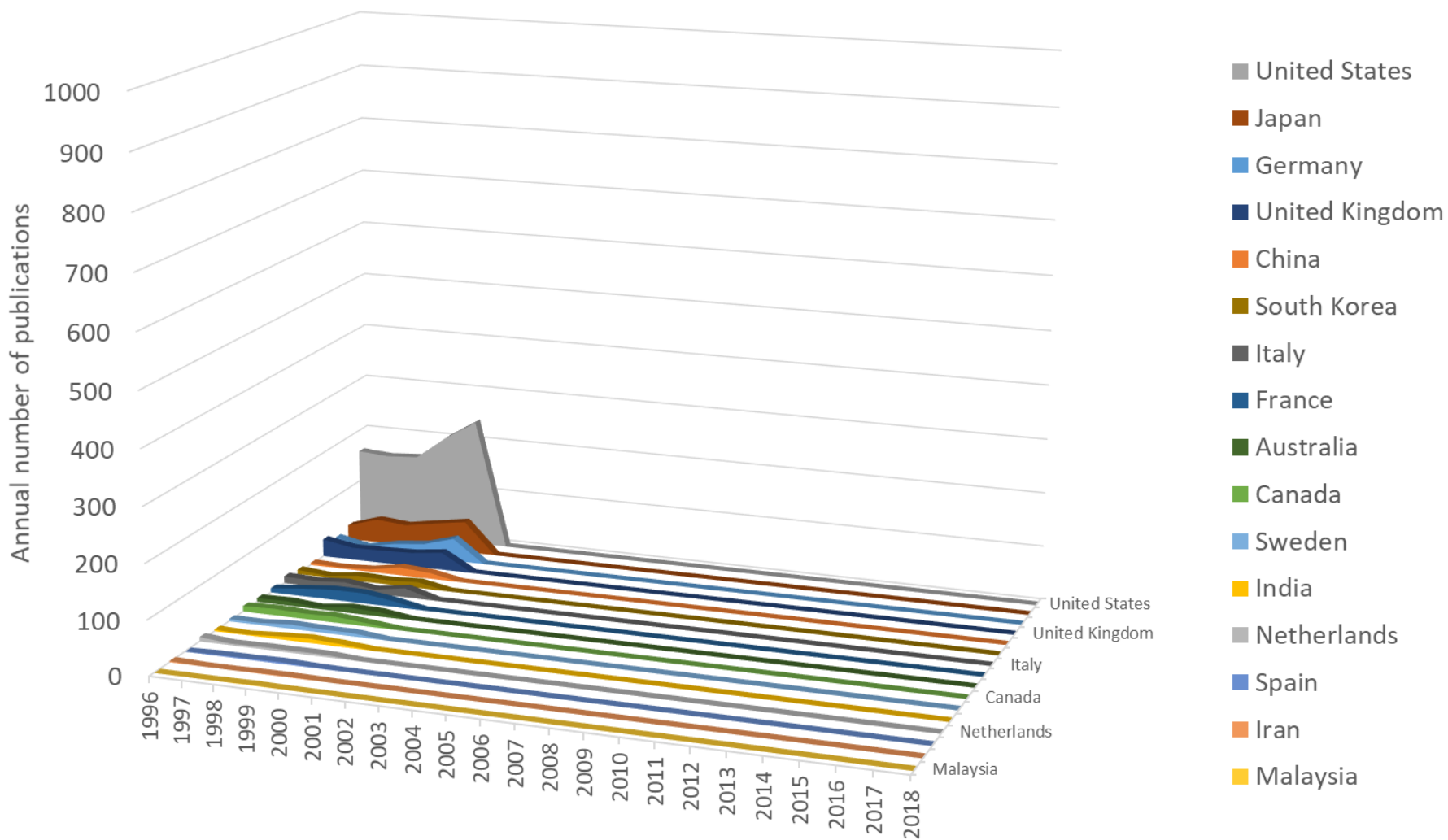
XEV publications top 16 countries (by volume)



1999		
Rank	Share	Country
1	40.8%	United States
2	10.1%	Japan
3	5.2%	Germany
4	5.2%	United Kingdom
5	3.8%	France
6	3.0%	China
7	2.2%	Canada
8	2.0%	Australia
9	1.6%	India
10	1.6%	Italy
11	1.6%	South Korea
12	1.2%	Sweden
13	0.8%	Netherlands
14	0.6%	Spain
15	0.2%	Iran
16	0.2%	Malaysia

EVS-16 Beijing, China

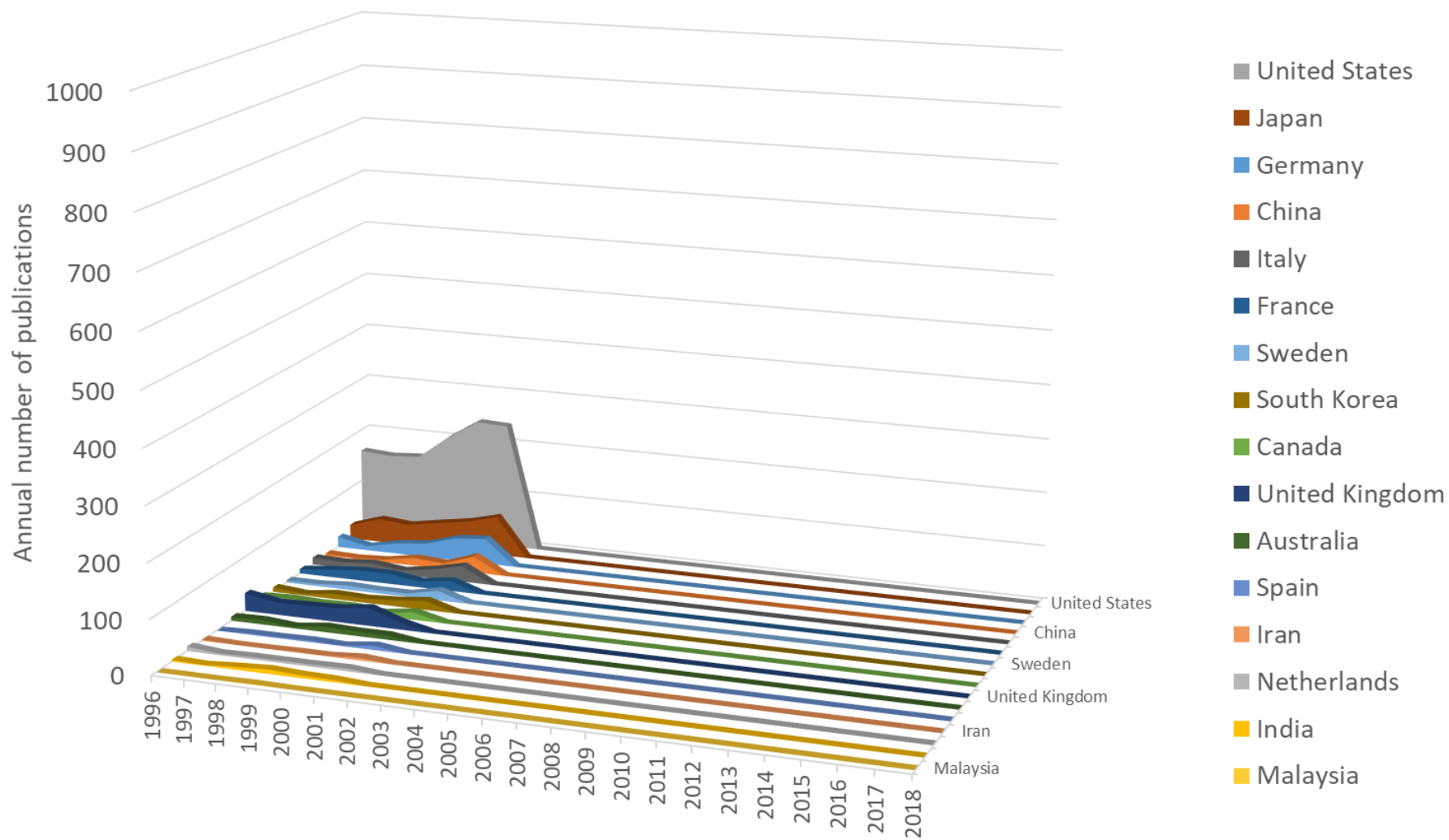
XEV publications top 16 countries (by volume)



2000		
Rank	Share	Country
1	41,7%	United States
2	10,3%	Japan
3	7,5%	Germany
4	5,8%	United Kingdom
5	3,0%	Italy
6	1,9%	China
7	1,9%	South Korea
8	1,9%	France
9	1,4%	Australia
10	1,0%	Canada
11	1,0%	Sweden
12	0,9%	India
13	0,7%	Netherlands
14	0,2%	Spain
15	0,2%	Iran
16	0,0%	Malaysia

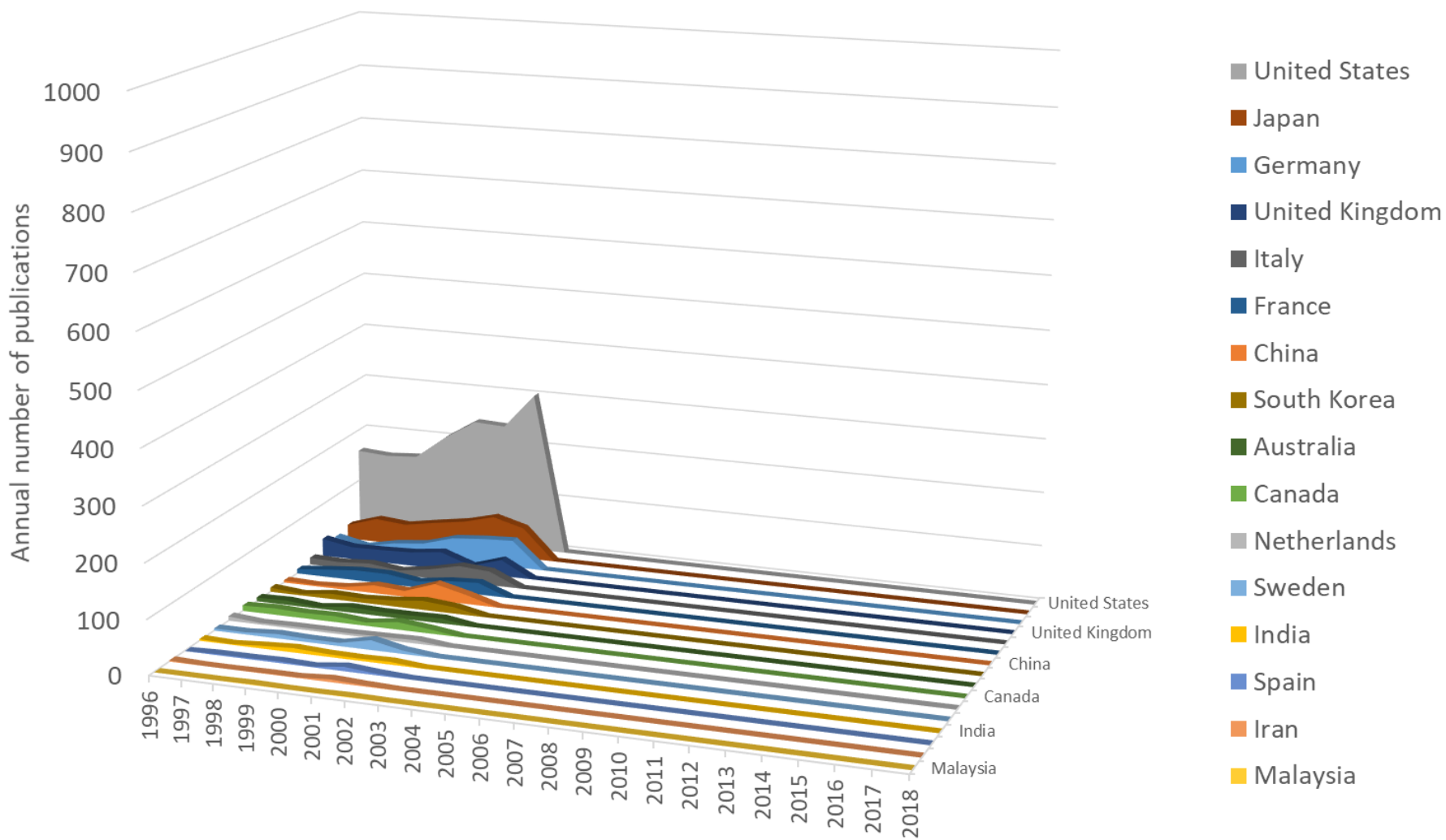
EVS-17 Montreal,
Canada

XEV publications top 16 countries (by volume)



2001		
Rank	Share	Country
1	36,8%	United States
2	11,5%	Japan
3	7,5%	Germany
4	4,8%	China
5	4,7%	Italy
6	3,0%	France
7	2,8%	Sweden
8	2,6%	South Korea
9	2,2%	Canada
10	2,0%	United Kingdom
11	1,2%	Australia
12	1,2%	Spain
13	0,8%	Iran
14	0,8%	Netherlands
15	0,6%	India
16	0,0%	Malaysia

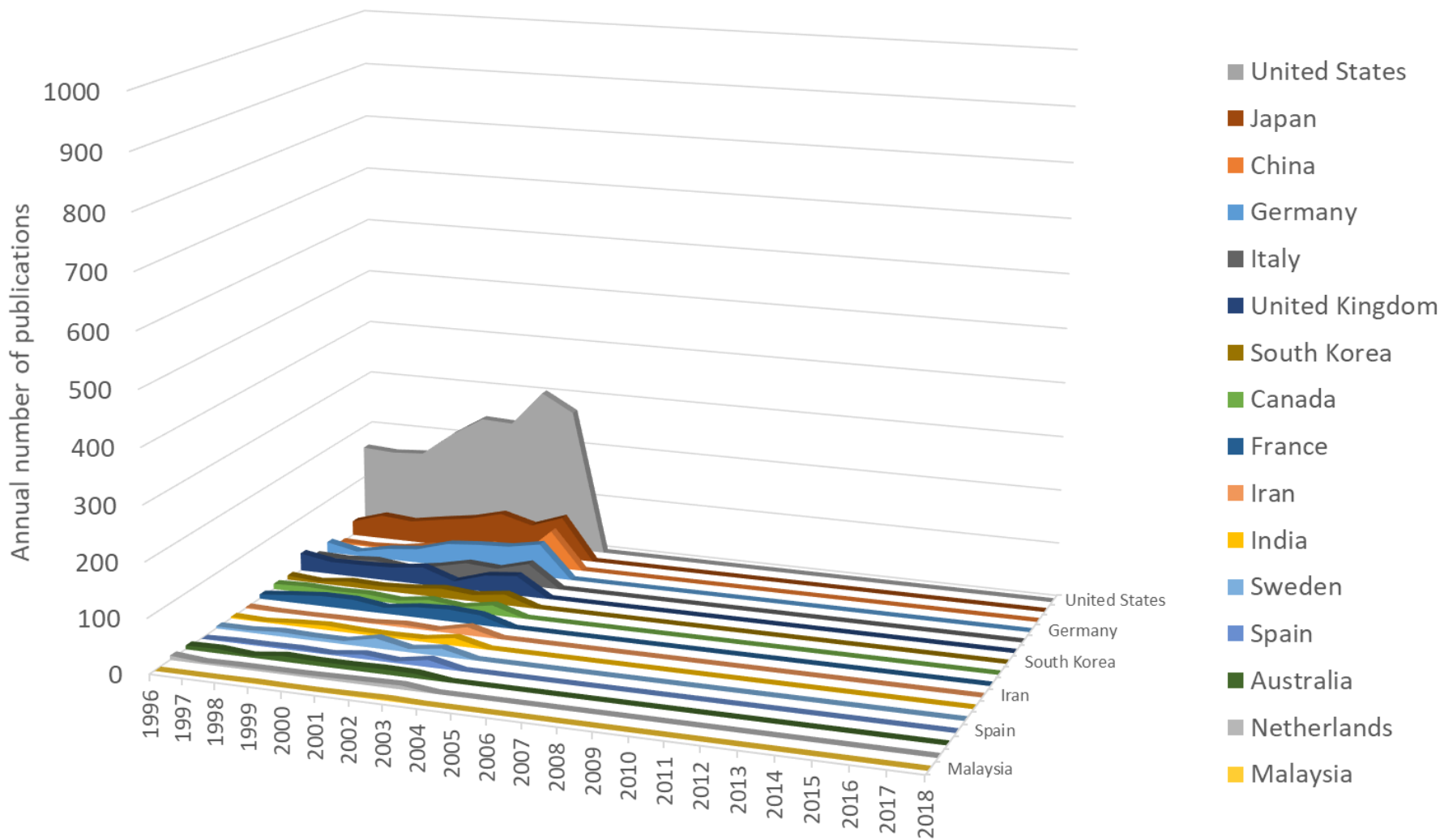
XEV publications top 16 countries (by volume)



2002		
Rank	Share	Country
1	37,8%	United States
2	7,3%	Japan
3	6,4%	Germany
4	3,9%	United Kingdom
5	3,3%	Italy
6	2,8%	France
7	2,1%	China
8	1,5%	South Korea
9	1,1%	Australia
10	1,0%	Canada
11	0,8%	Netherlands
12	0,8%	Sweden
13	0,6%	India
14	0,4%	Spain
15	0,3%	Iran
16	0,1%	Malaysia

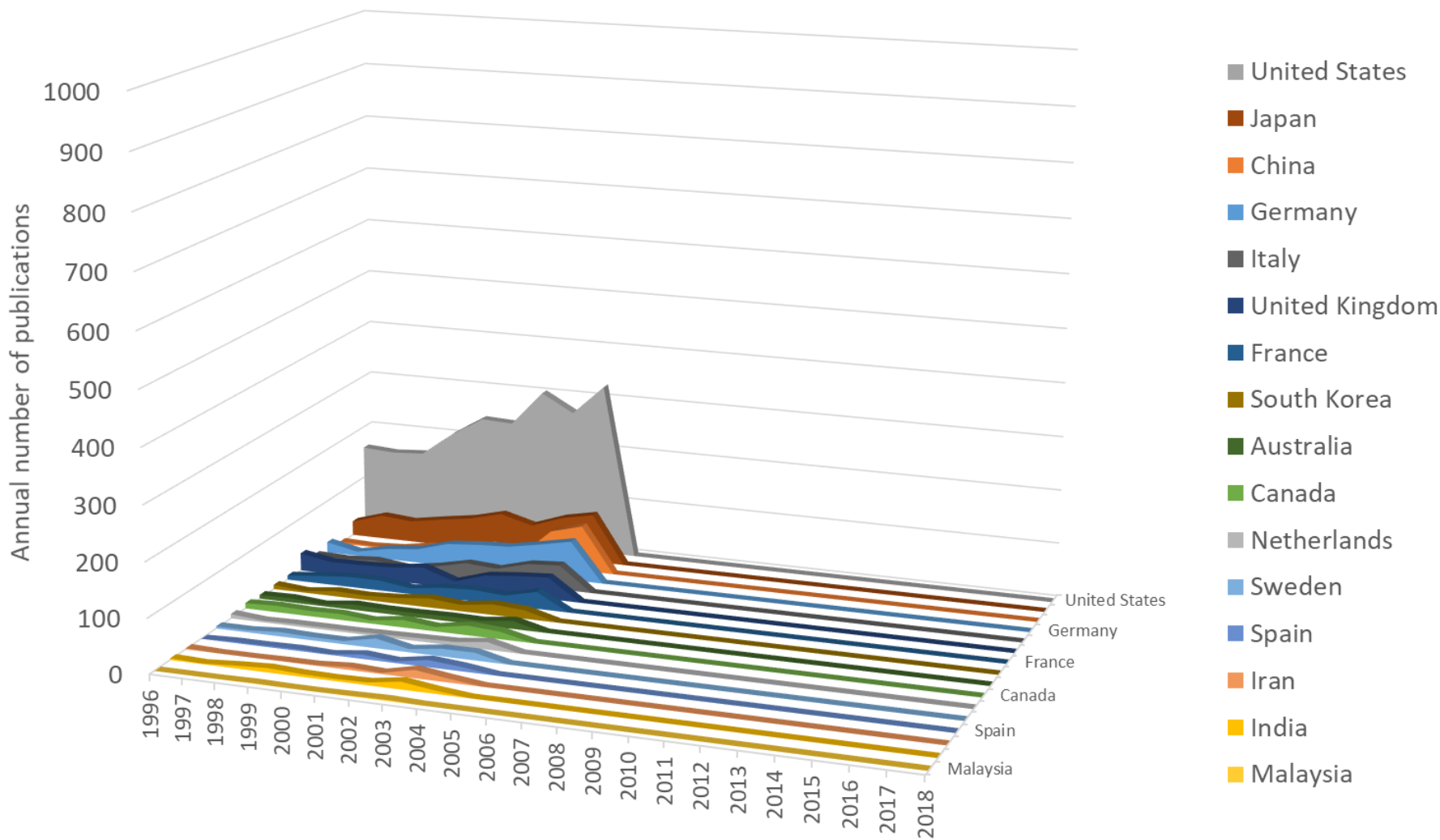
EVS-19 Busan, South Korea

XEV publications top 16 countries (by volume)



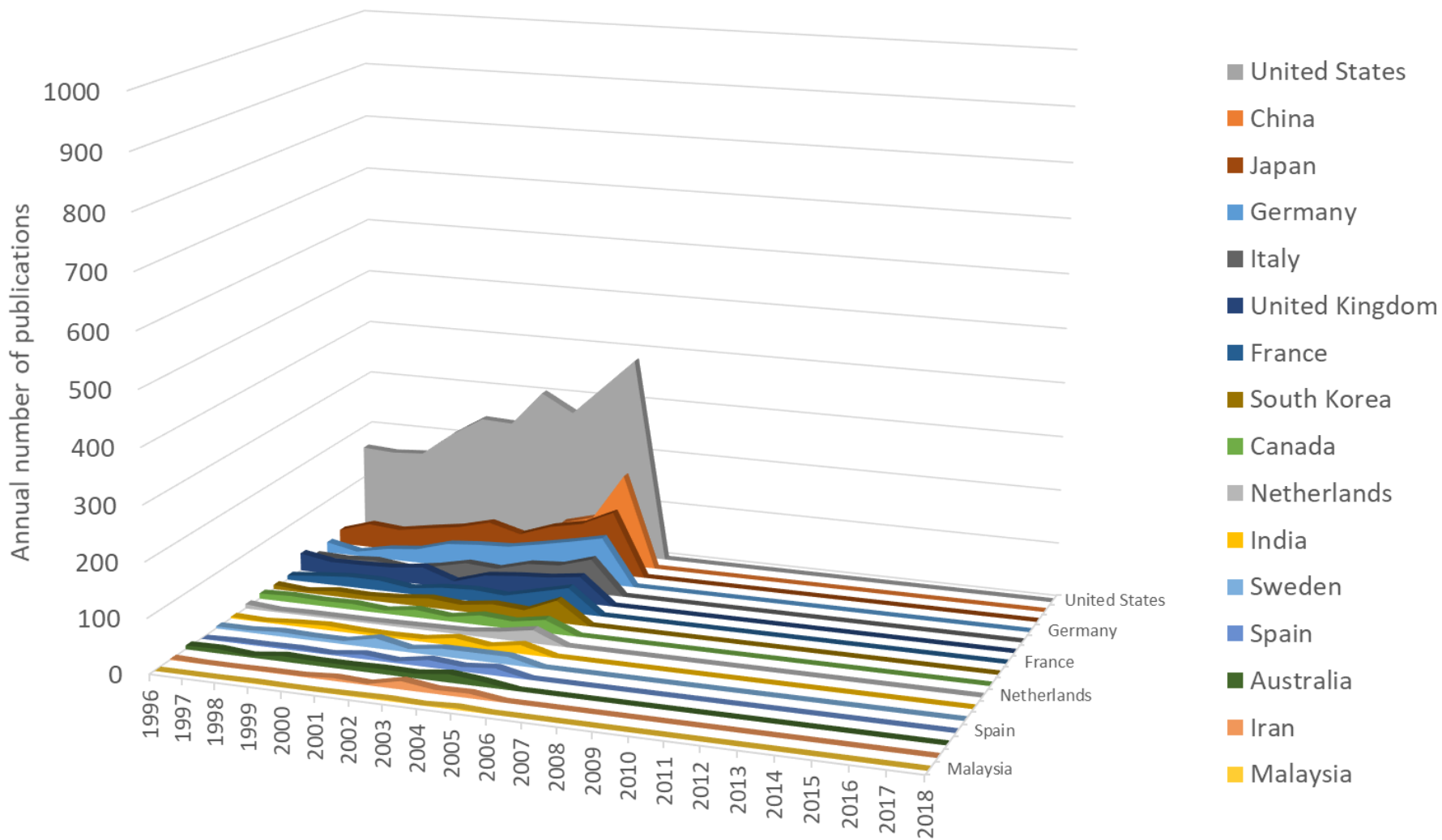
2003		
Rank	Share	Country
1	27,9%	United States
2	8,2%	Japan
3	7,3%	China
4	6,5%	Germany
5	4,4%	Italy
6	3,9%	United Kingdom
7	2,1%	South Korea
8	1,9%	Canada
9	1,9%	France
10	1,6%	Iran
11	1,5%	India
12	1,5%	Sweden
13	1,4%	Spain
14	0,8%	Australia
15	0,7%	Netherlands
16	0,2%	Malaysia

XEV publications top 16 countries (by volume)



2004		
Rank	Share	Country
1	29,9%	United States
2	8,4%	Japan
3	7,9%	China
4	6,8%	Germany
5	4,3%	Italy
6	3,8%	United Kingdom
7	3,0%	France
8	1,5%	South Korea
9	1,4%	Australia
10	1,3%	Canada
11	1,3%	Netherlands
12	1,3%	Sweden
13	0,7%	Spain
14	0,6%	Iran
15	0,6%	India
16	0,0%	Malaysia

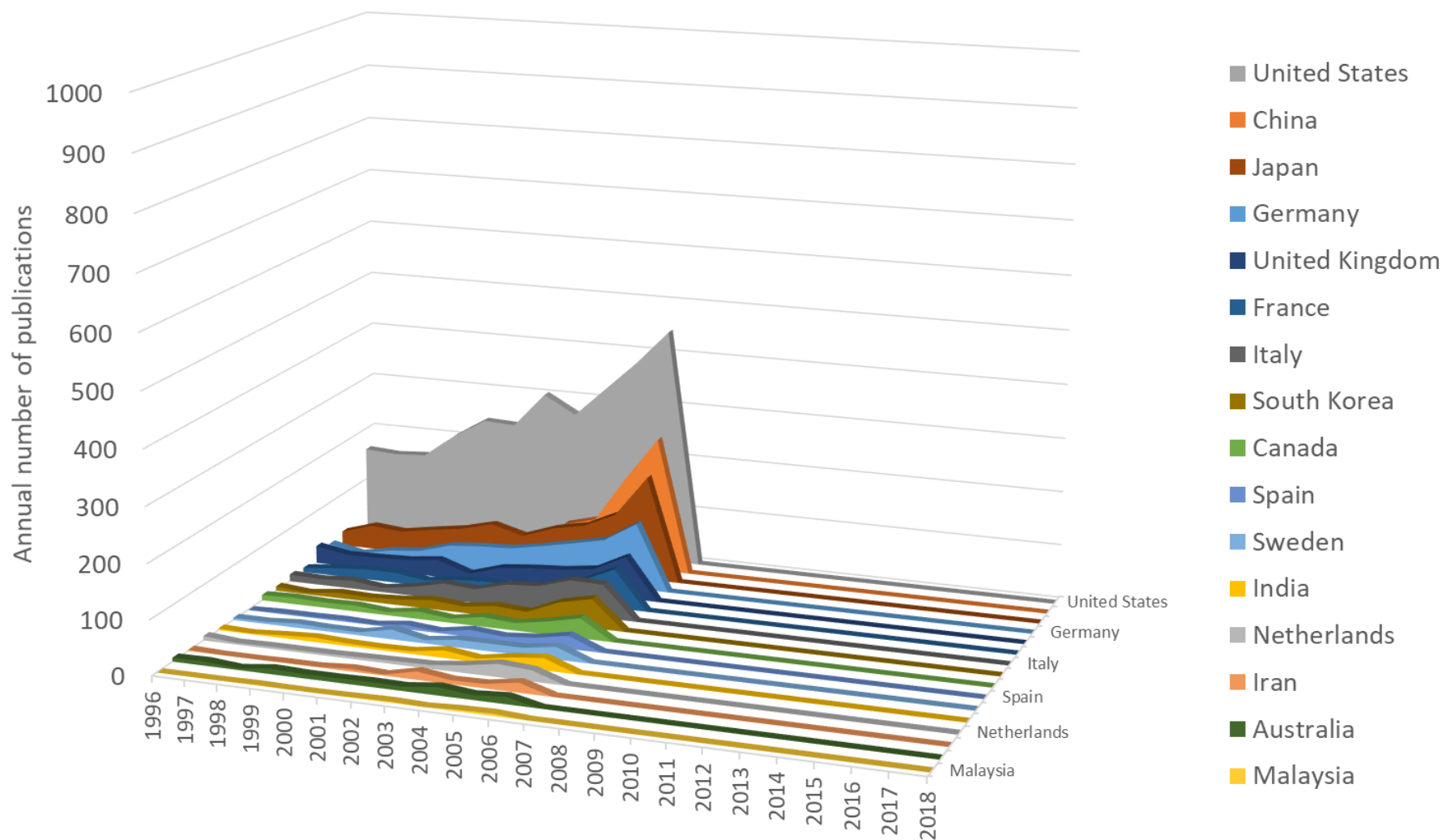
XEV publications top 16 countries (by volume)



2005		
Rank	Share	Country
1	26,7%	United States
2	12,2%	China
3	8,4%	Japan
4	6,1%	Germany
5	4,5%	Italy
6	3,4%	United Kingdom
7	3,2%	France
8	2,9%	South Korea
9	1,7%	Canada
10	1,7%	Netherlands
11	1,1%	India
12	1,0%	Sweden
13	0,9%	Spain
14	0,6%	Australia
15	0,6%	Iran
16	0,2%	Malaysia

EVS-21 Monte-Carlo,
Monaco

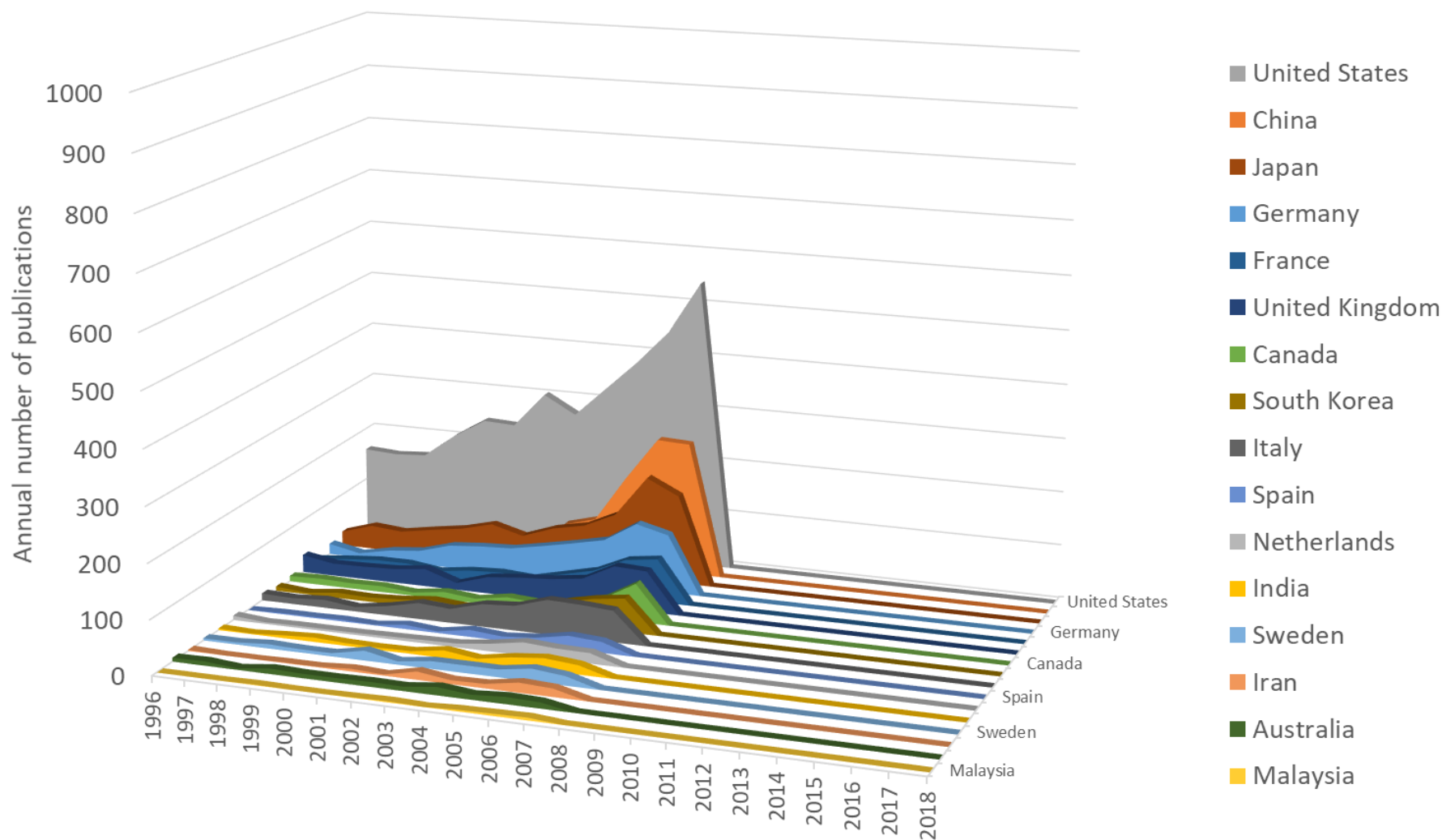
XEV publications top 16 countries (by volume)



2006		
Rank	Share	Country
1	24,8%	United States
2	14,1%	China
3	10,9%	Japan
4	6,9%	Germany
5	4,4%	United Kingdom
6	4,1%	France
7	3,5%	Italy
8	3,0%	South Korea
9	2,1%	Canada
10	1,3%	Spain
11	1,3%	Sweden
12	1,2%	India
13	1,1%	Netherlands
14	1,0%	Iran
15	0,7%	Australia
16	0,2%	Malaysia

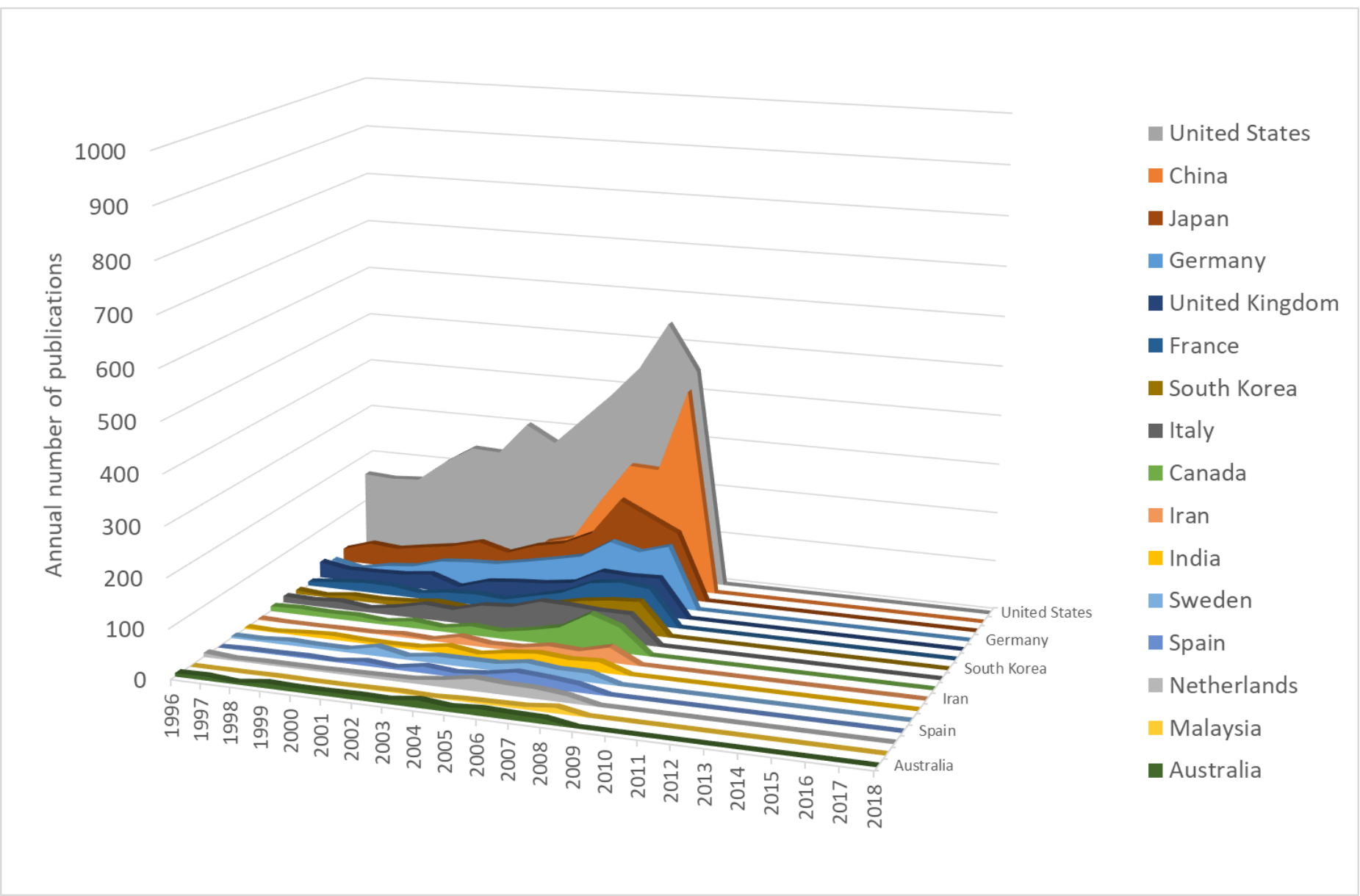
EVS-22 Yokohama, Japan

XEV publications top 16 countries (by volume)



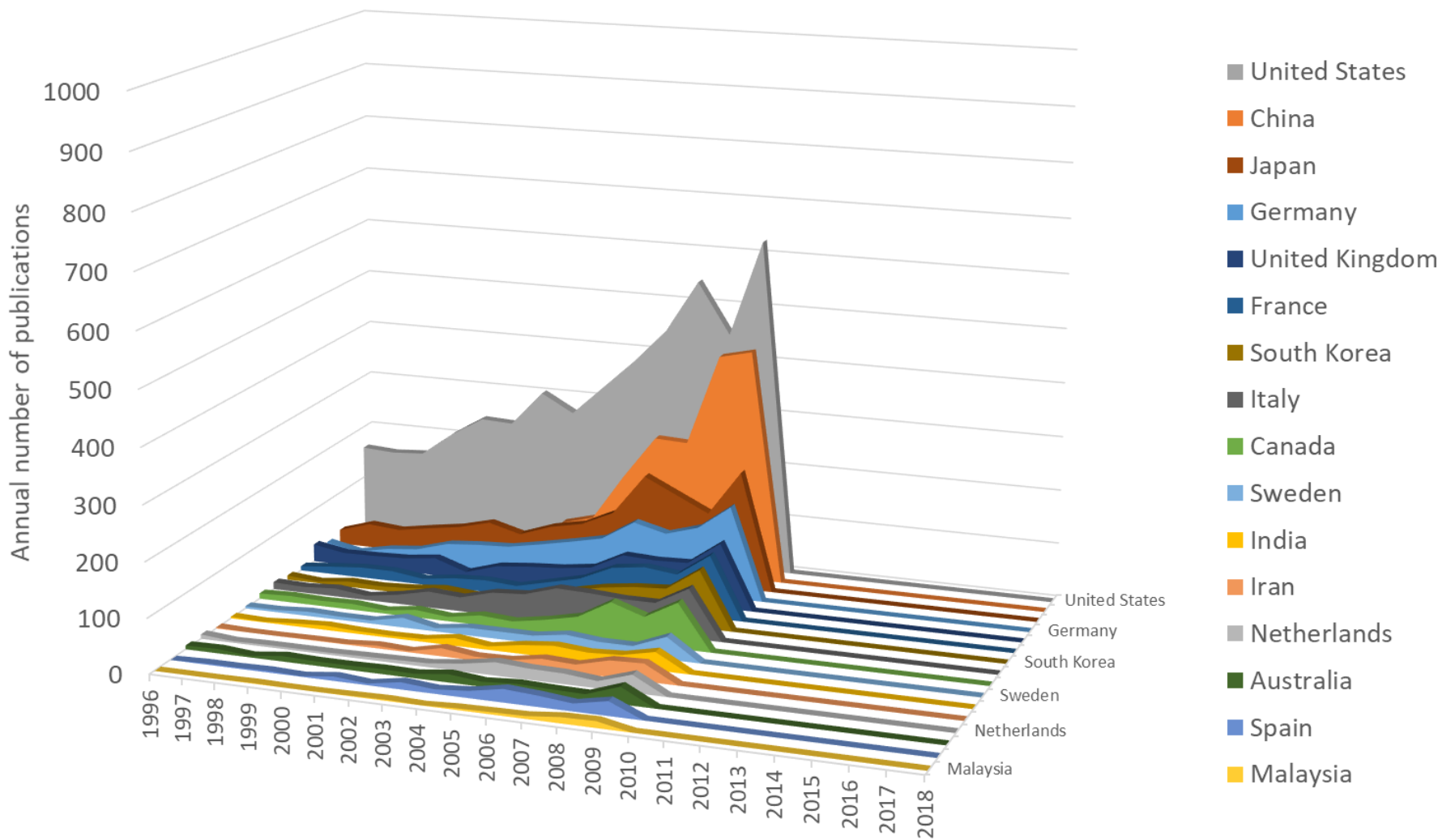
2007		
Rank	Share	Country
1	29,8%	United States
2	13,7%	China
3	9,2%	Japan
4	6,0%	Germany
5	4,5%	France
6	4,2%	United Kingdom
7	3,9%	Canada
8	3,4%	South Korea
9	3,2%	Italy
10	1,1%	Spain
11	1,0%	Netherlands
12	0,9%	India
13	0,9%	Sweden
14	0,8%	Iran
15	0,6%	Australia
16	0,3%	Malaysia

XEV publications top 16 countries (by volume)



2008		
Rank	Share	Country
1	23,8%	United States
2	22,3%	China
3	7,3%	Japan
4	6,8%	Germany
5	4,2%	United Kingdom
6	3,9%	France
7	3,5%	South Korea
8	3,1%	Italy
9	2,7%	Canada
10	1,6%	Iran
11	1,1%	India
12	0,9%	Sweden
13	0,7%	Spain
14	0,7%	Netherlands
15	0,6%	Malaysia
16	0,5%	Australia

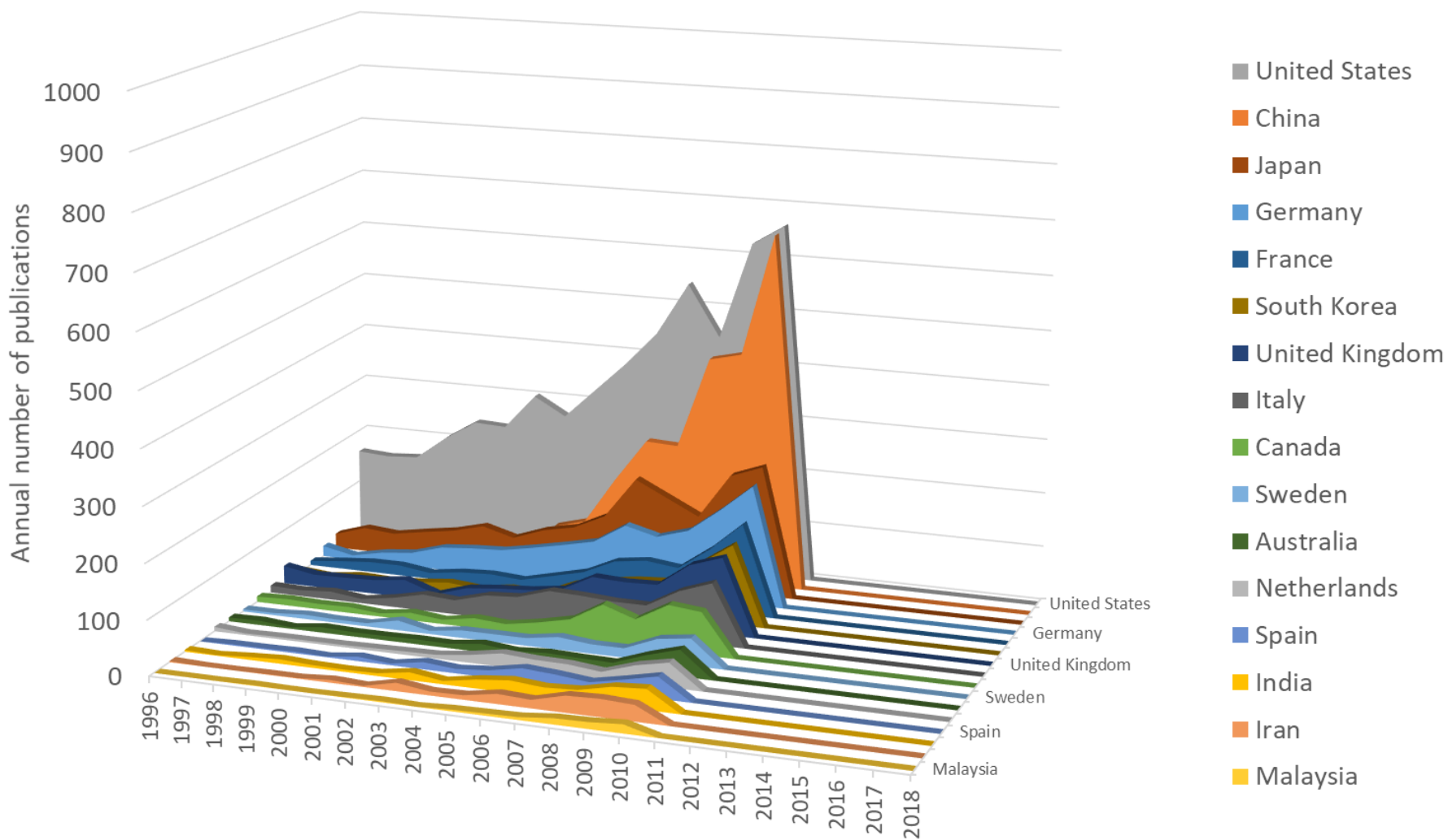
XEV publications top 16 countries (by volume)



2009		
Rank	Share	Country
1	23,7%	United States
2	16,4%	China
3	8,3%	Japan
4	6,5%	Germany
5	4,6%	United Kingdom
6	4,4%	France
7	4,1%	South Korea
8	3,5%	Italy
9	3,2%	Canada
10	1,6%	Sweden
11	1,3%	India
12	1,2%	Iran
13	1,2%	Netherlands
14	1,2%	Australia
15	1,0%	Spain
16	0,5%	Malaysia

EVS-24 Stavanger,
Norway

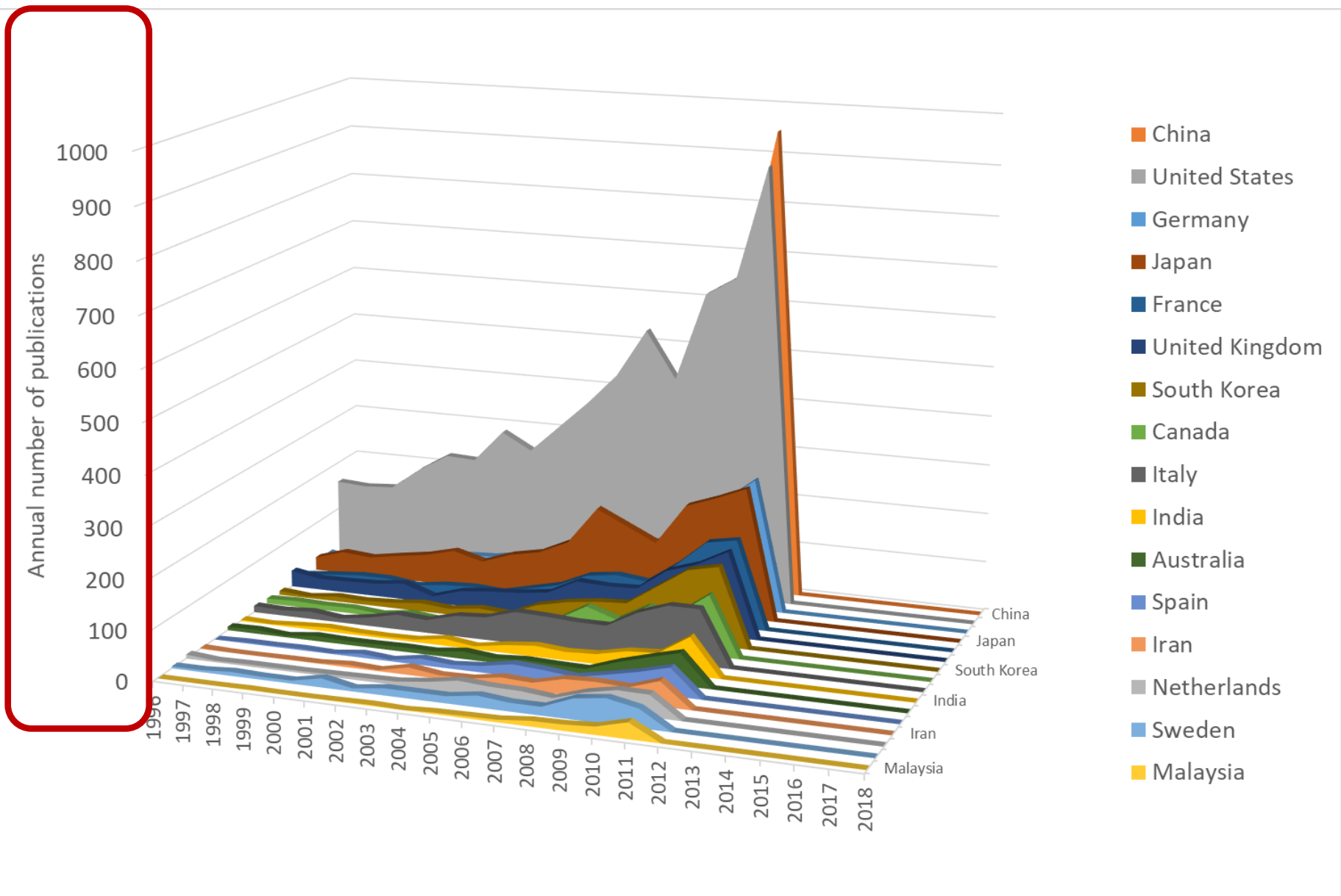
XEV publications top 16 countries (by volume)



2010		
Rank	Share	Country
1	20,0%	United States
2	19,8%	China
3	7,3%	Japan
4	6,7%	Germany
5	5,1%	France
6	4,4%	South Korea
7	4,3%	United Kingdom
8	3,4%	Italy
9	2,4%	Canada
10	1,5%	Sweden
11	1,5%	Australia
12	1,3%	Netherlands
13	1,2%	Spain
14	1,1%	India
15	0,9%	Iran
16	0,5%	Malaysia

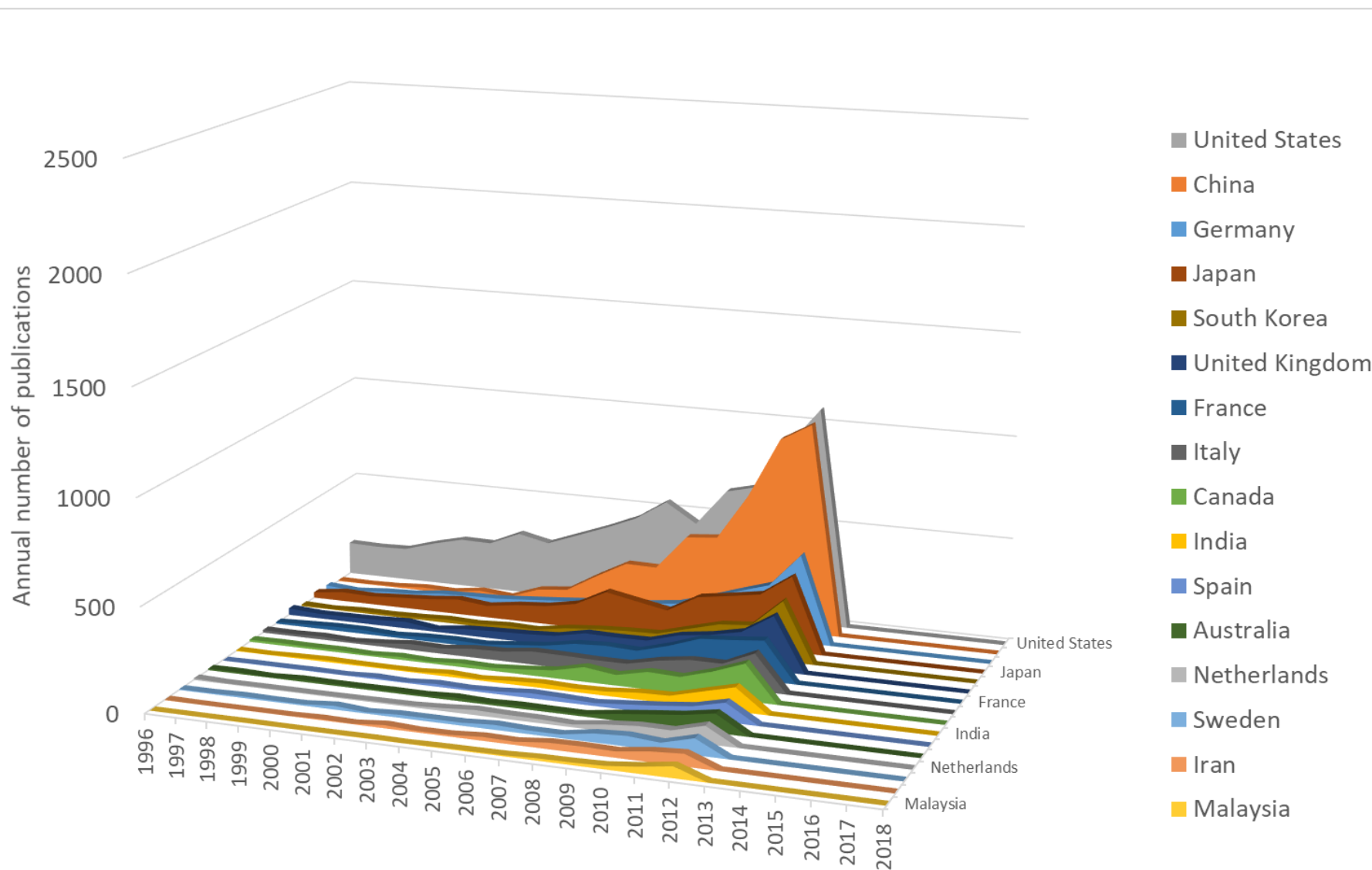
EVS-25 Shenzhen, China

XEV publications top 16 countries (by volume)



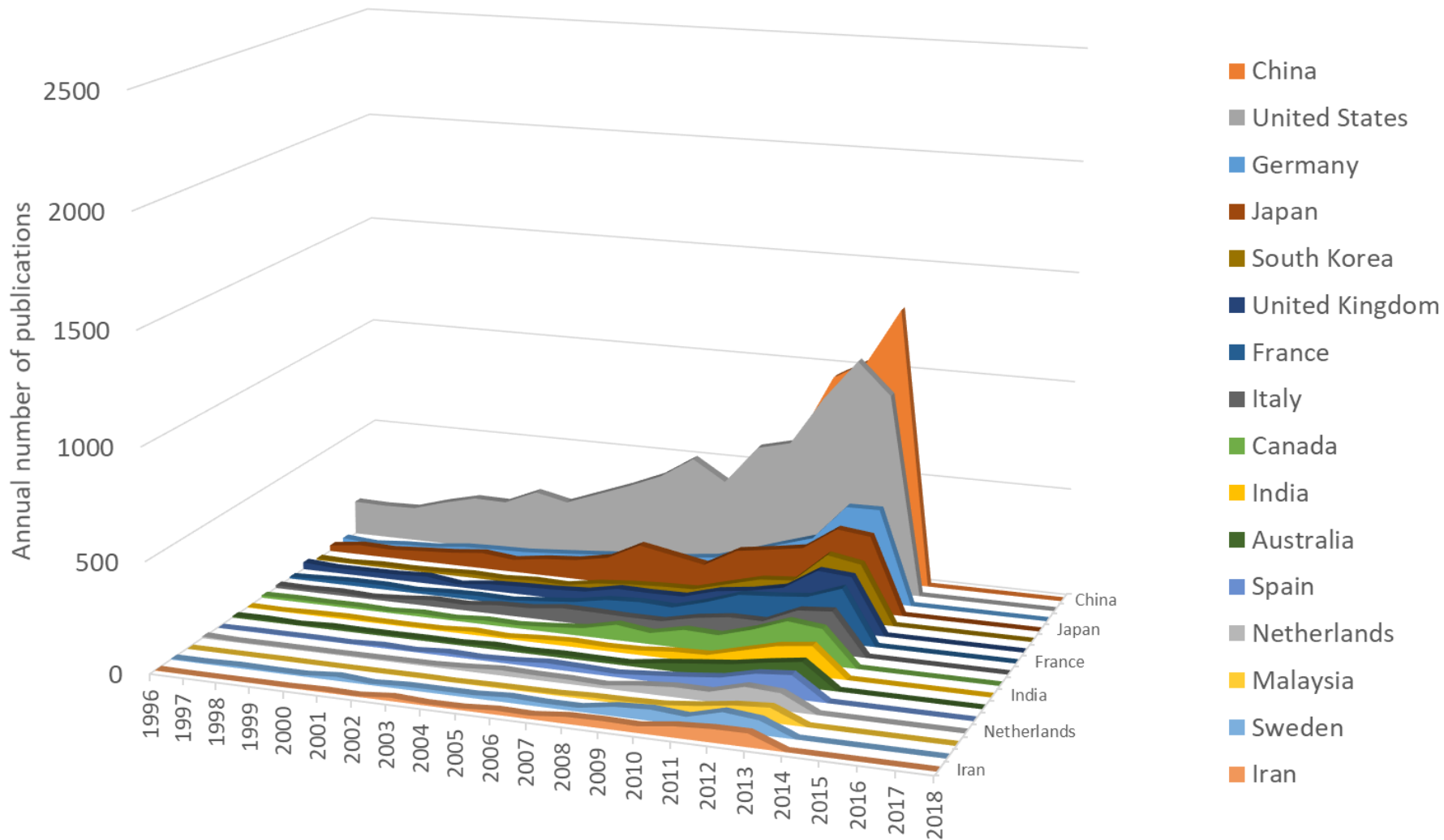
2011		
Rank	Share	Country
1	23,4%	China
2	21,9%	United States
3	6,6%	Germany
4	6,6%	Japan
5	4,4%	France
6	4,3%	United Kingdom
7	3,9%	South Korea
8	3,0%	Canada
9	2,8%	Italy
10	1,9%	India
11	1,6%	Australia
12	1,4%	Spain
13	1,2%	Iran
14	1,1%	Netherlands
15	0,9%	Sweden
16	0,8%	Malaysia

XEV publications top 16 countries (by volume)



2012		
Rank	Share	Country
1	20,1%	United States
2	19,4%	China
3	8,1%	Germany
4	7,0%	Japan
5	5,5%	South Korea
6	5,0%	United Kingdom
7	3,6%	France
8	3,4%	Italy
9	3,3%	Canada
10	2,1%	India
11	1,7%	Spain
12	1,7%	Australia
13	1,6%	Netherlands
14	1,4%	Sweden
15	1,1%	Iran
16	1,0%	Malaysia

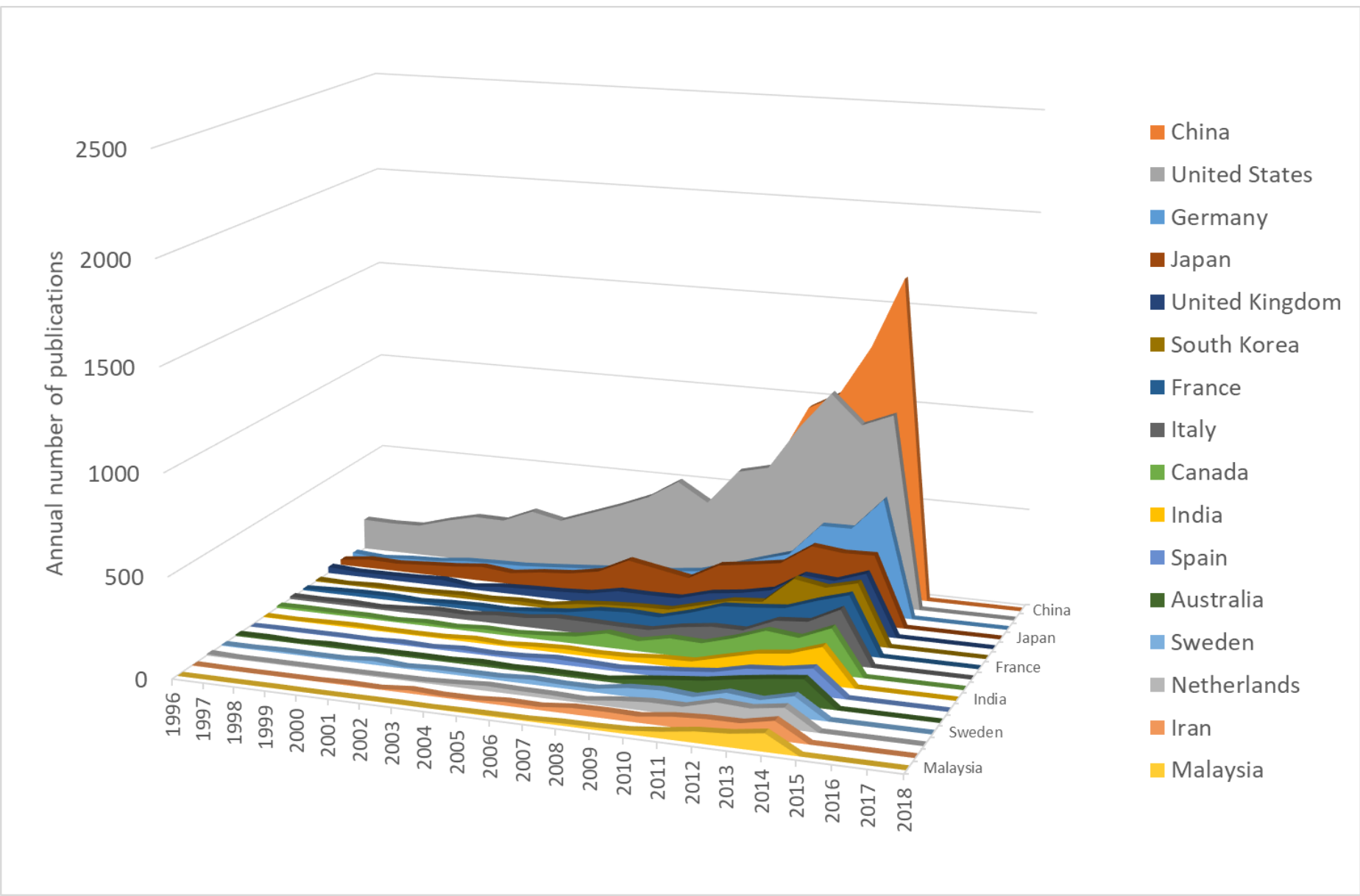
XEV publications top 16 countries (by volume)



2013		
Rank	Share	Country
1	23,7%	China
2	17,1%	United States
3	8,0%	Germany
4	6,5%	Japan
5	4,9%	South Korea
6	4,7%	United Kingdom
7	4,6%	France
8	3,5%	Italy
9	3,0%	Canada
10	2,5%	India
11	2,1%	Australia
12	1,9%	Spain
13	1,4%	Netherlands
14	1,2%	Malaysia
15	1,1%	Sweden
16	1,1%	Iran

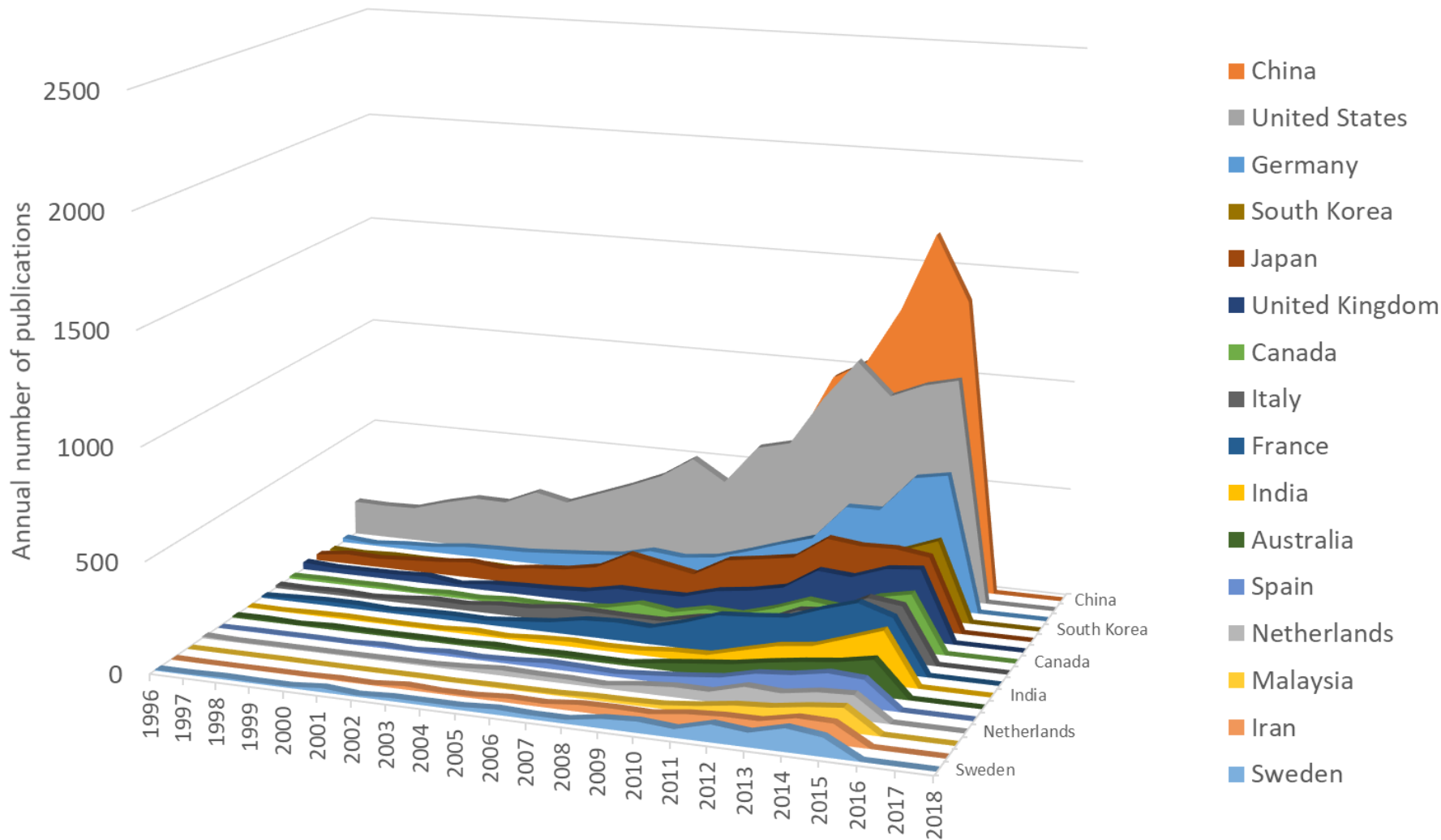
EVS-27 Barcelona, Spain

XEV publications top 16 countries (by volume)



2014		
Rank	Share	Country
1	25,0%	China
2	15,0%	United States
3	9,1%	Germany
4	5,4%	Japan
5	4,7%	United Kingdom
6	4,7%	South Korea
7	4,5%	France
8	4,1%	Italy
9	3,5%	Canada
10	2,8%	India
11	2,0%	Spain
12	2,0%	Australia
13	1,5%	Sweden
14	1,5%	Netherlands
15	1,4%	Iran
16	1,3%	Malaysia

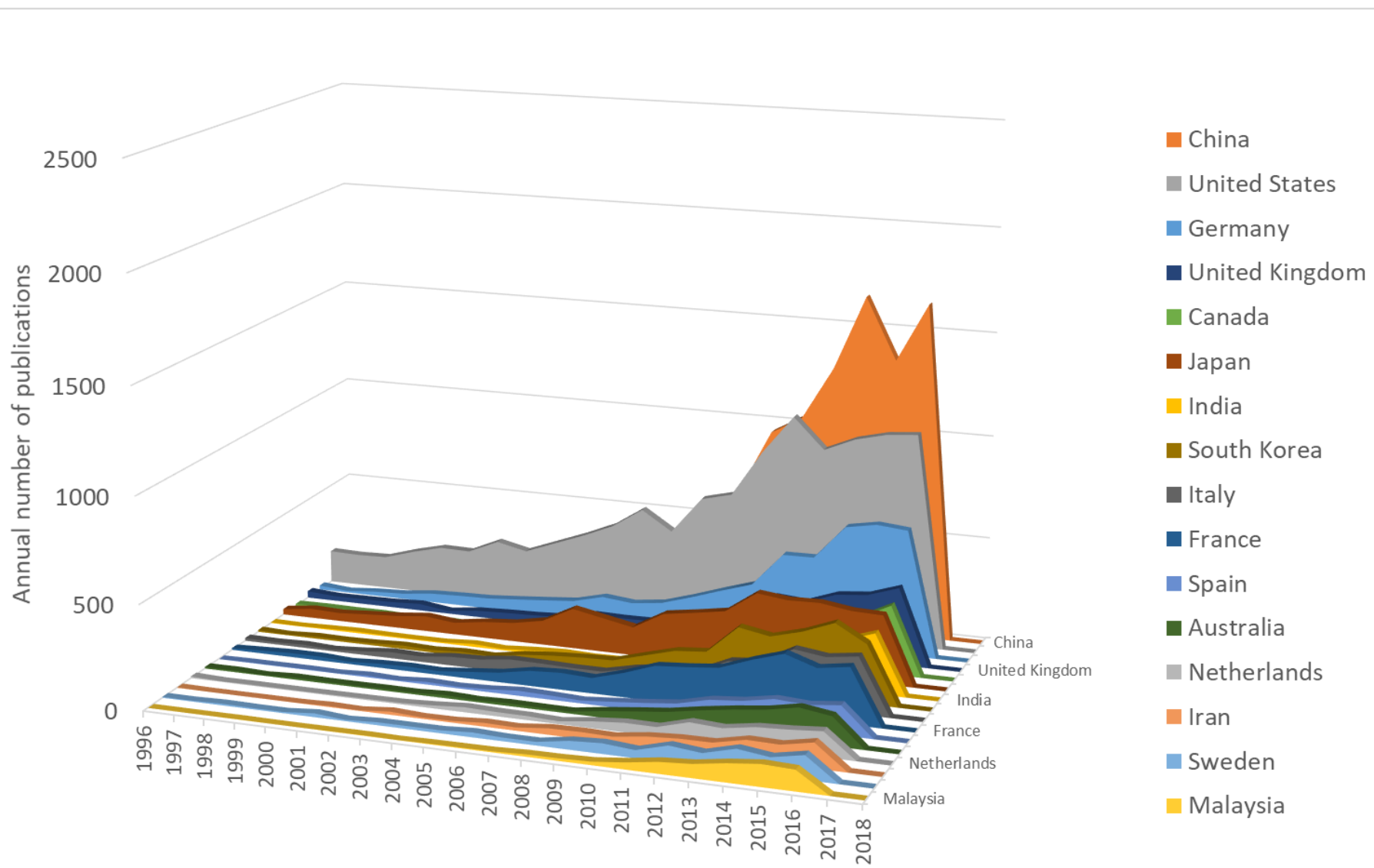
XEV publications top 16 countries (by volume)



2015		
Rank	Share	Country
1	21,7%	China
2	16,5%	United States
3	10,1%	Germany
4	5,9%	South Korea
5	5,4%	Japan
6	5,2%	United Kingdom
7	4,2%	Canada
8	4,0%	Italy
9	4,0%	France
10	3,8%	India
11	2,6%	Australia
12	2,0%	Spain
13	1,7%	Netherlands
14	1,7%	Malaysia
15	1,4%	Iran
16	1,3%	Sweden

EVS-28 Goyang, South Korea

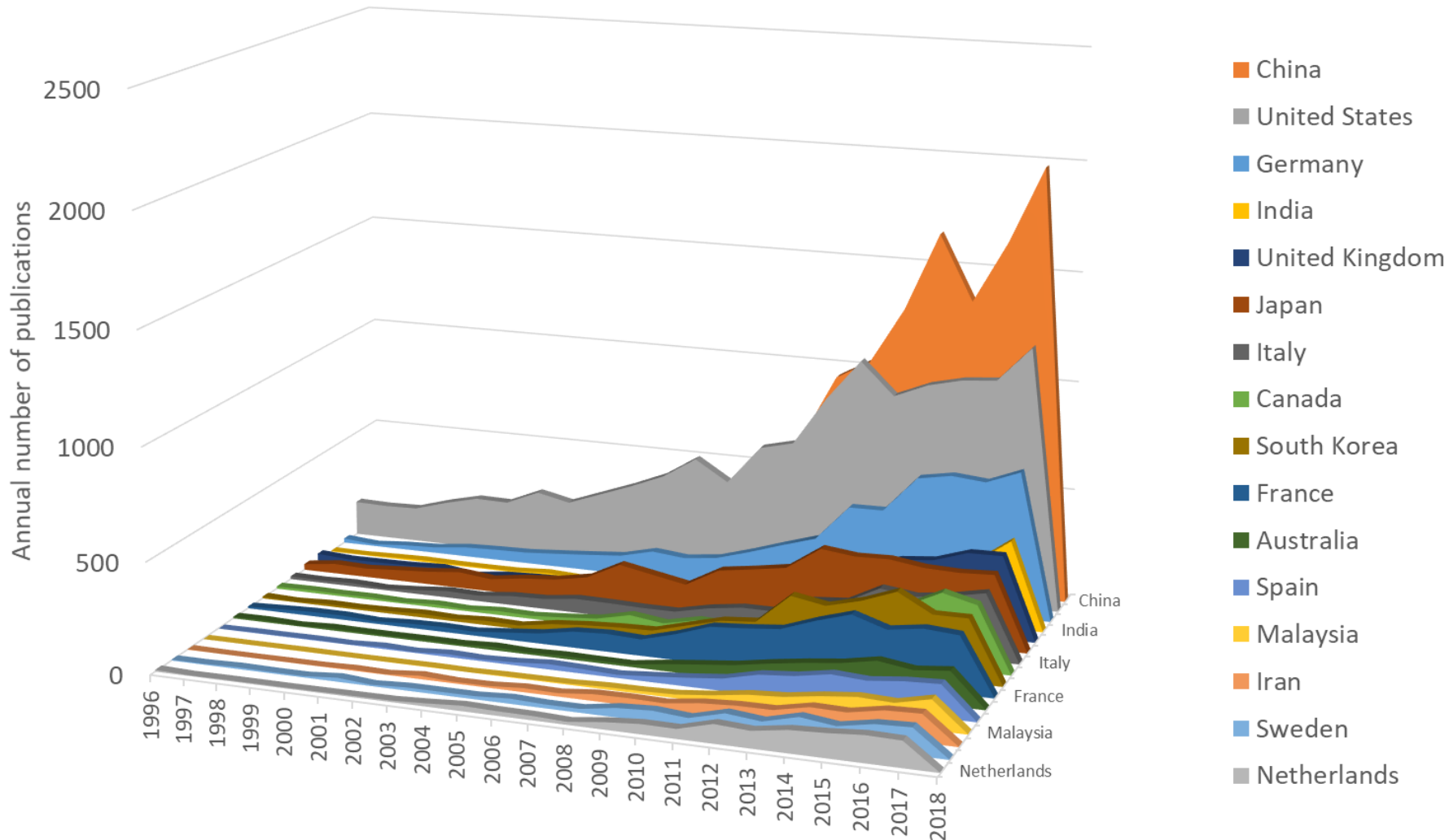
XEV publications top 16 countries (by volume)



2016		
Rank	Share	Country
1	24,7%	China
2	15,7%	United States
3	9,3%	Germany
4	5,7%	United Kingdom
5	5,0%	Canada
6	5,0%	Japan
7	4,4%	India
8	4,3%	South Korea
9	4,1%	Italy
10	4,1%	France
11	2,1%	Spain
12	2,1%	Australia
13	1,8%	Netherlands
14	1,8%	Iran
15	1,7%	Sweden
16	1,5%	Malaysia

EVS-29 Montréal,
Canada

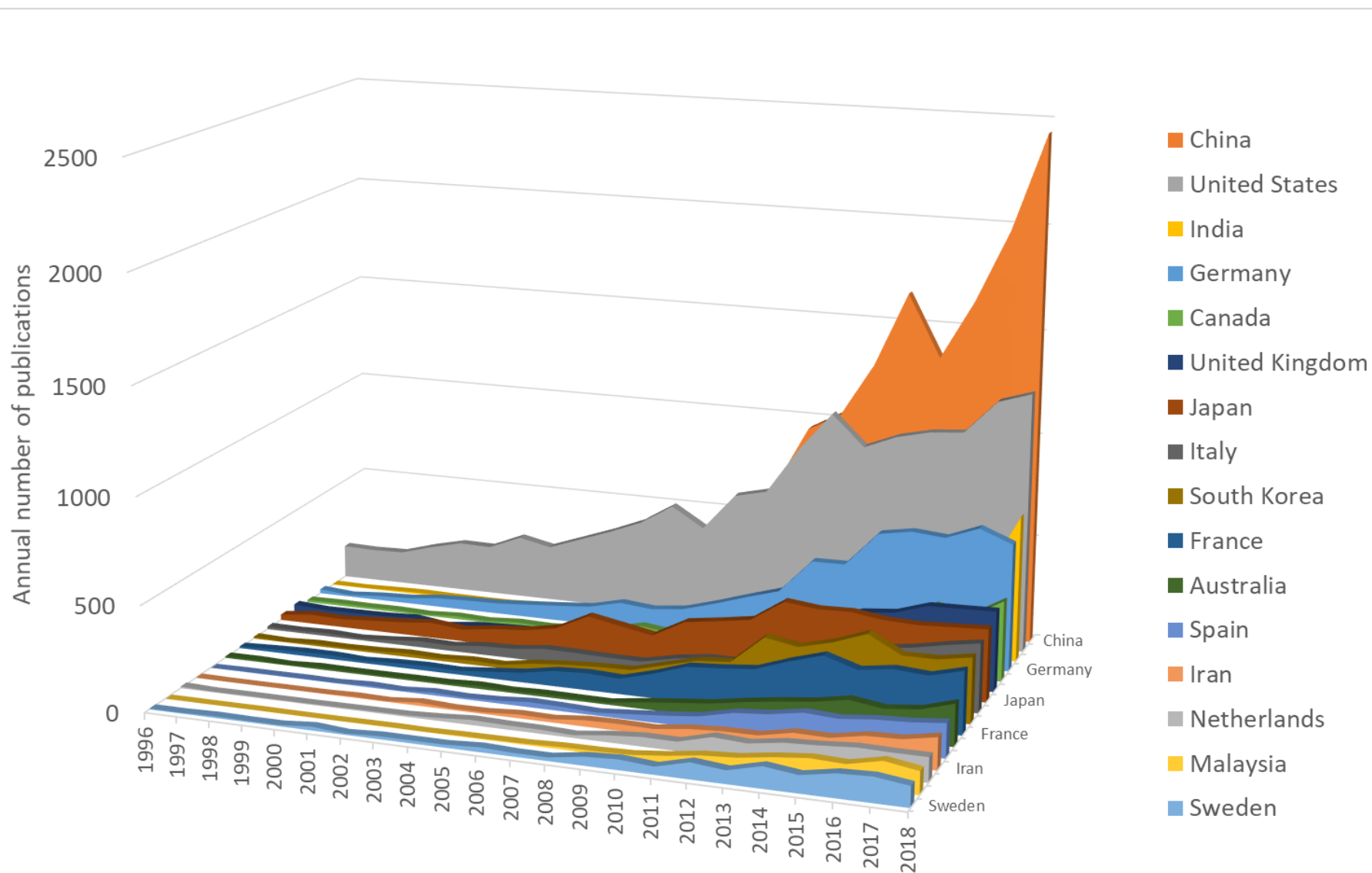
XEV publications top 16 countries (by volume)



2017		
Rank	Share	Country
1	27,0%	China
2	16,4%	United States
3	9,2%	Germany
4	5,5%	India
5	5,2%	United Kingdom
6	4,6%	Japan
7	4,1%	Italy
8	4,0%	Canada
9	3,9%	South Korea
10	3,5%	France
11	2,1%	Australia
12	2,0%	Spain
13	1,8%	Malaysia
14	1,7%	Iran
15	1,6%	Sweden
16	1,6%	Netherlands

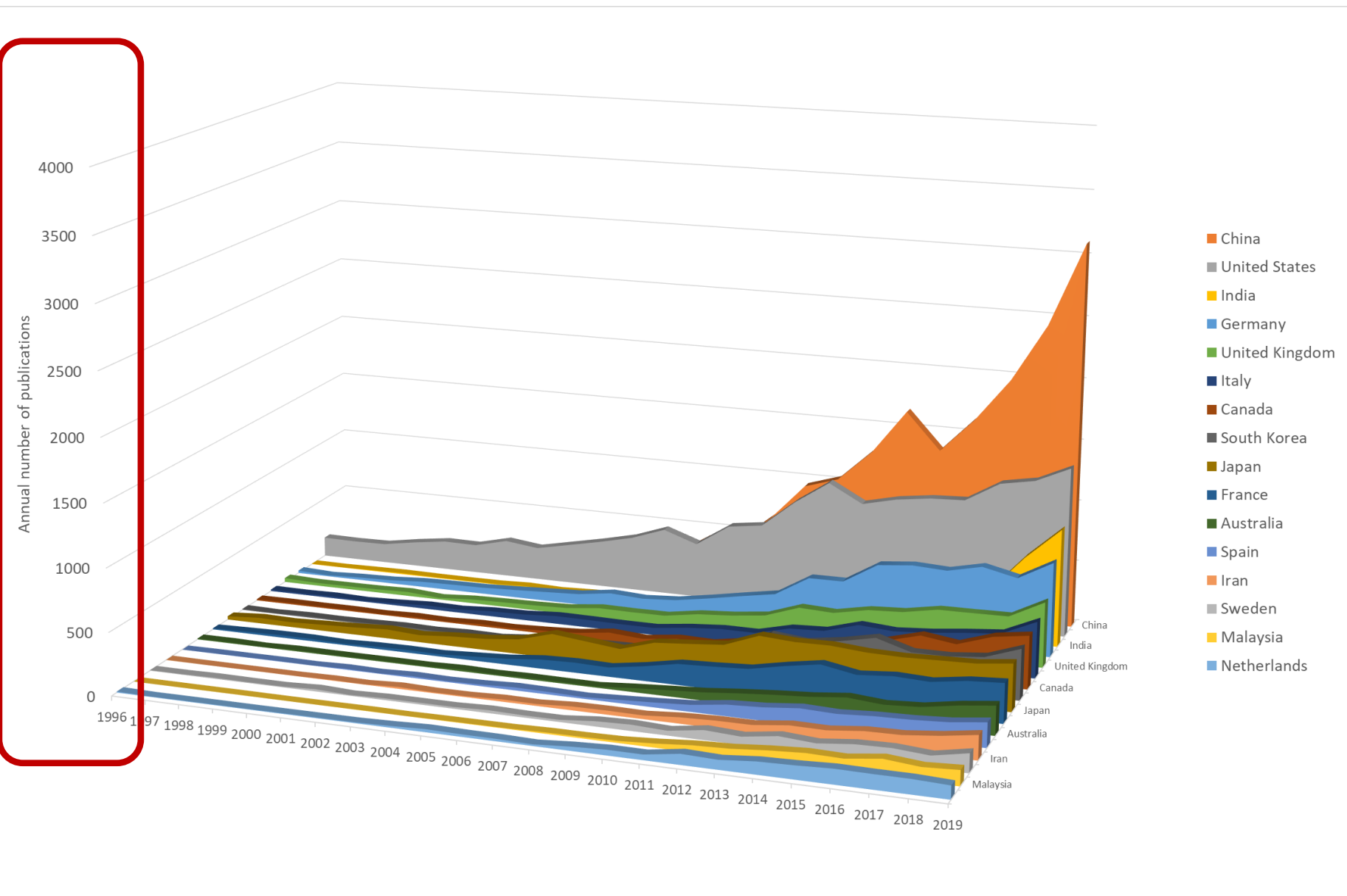
EVS-30 Stuttgart,
Germany

XEV publications top 16 countries (by volume)



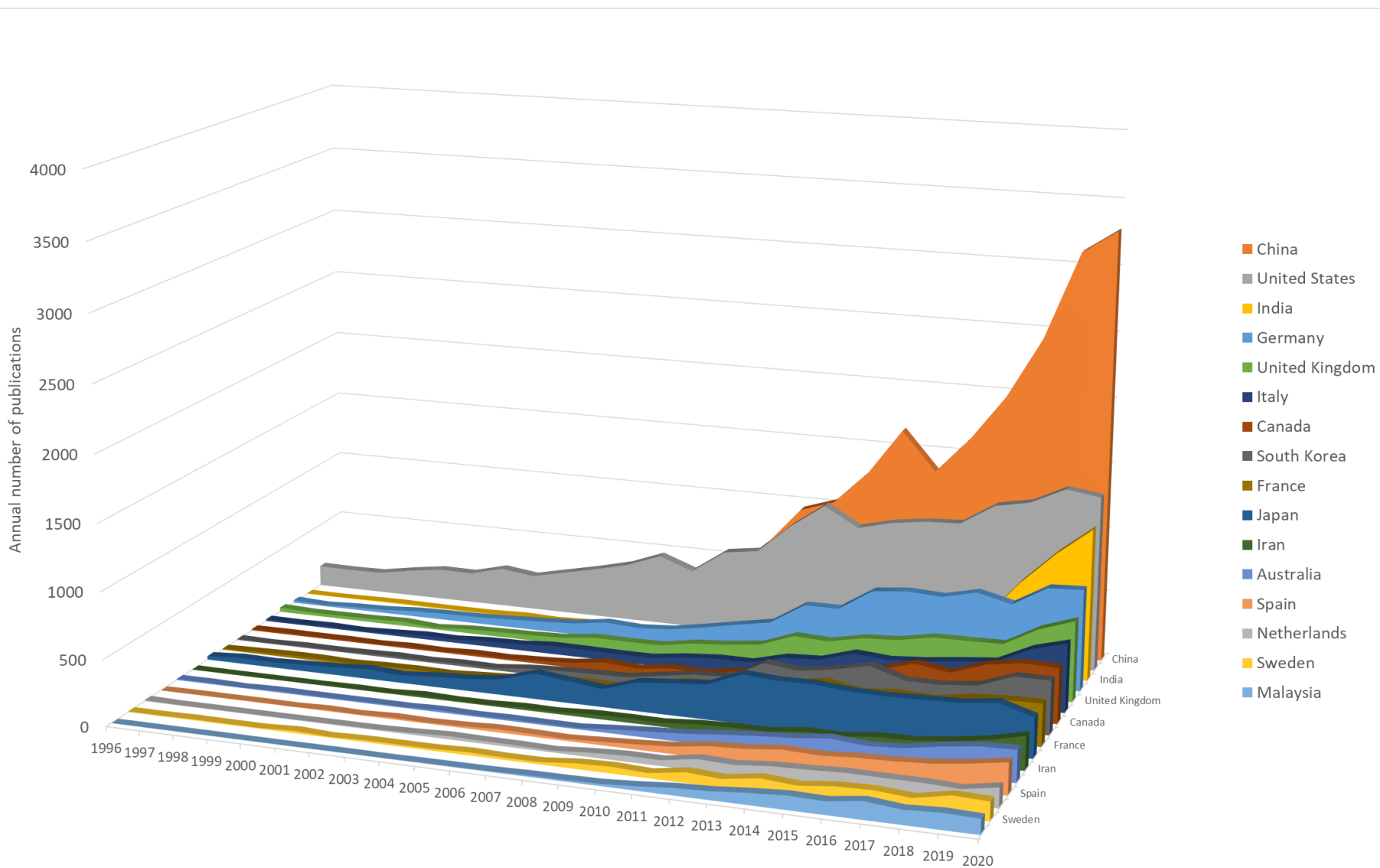
2018		
Rank	Share	Country
1	29,0%	China
2	14,9%	United States
3	8,3%	India
4	7,3%	Germany
5	4,6%	Canada
6	4,6%	United Kingdom
7	4,1%	Japan
8	3,9%	Italy
9	3,7%	South Korea
10	3,6%	France
11	2,4%	Australia
12	1,9%	Spain
13	1,8%	Iran
14	1,4%	Netherlands
15	1,3%	Malaysia
16	1,2%	Sweden

XEV publications top 16 countries (by volume)



2019		
Rank	Share	Country
1	30.0%	China
2	13.3%	United States
3	9.2%	India
4	7.4%	Germany
5	5.1%	United Kingdom
6	4.4%	Italy
7	4.1%	Canada
8	3.9%	South Korea
9	3.7%	Japan
10	3.1%	France
11	2.2%	Australia
12	1.9%	Spain
13	1.9%	Iran
14	1.4%	Sweden
15	1.2%	Malaysia
16	1.0%	Netherlands

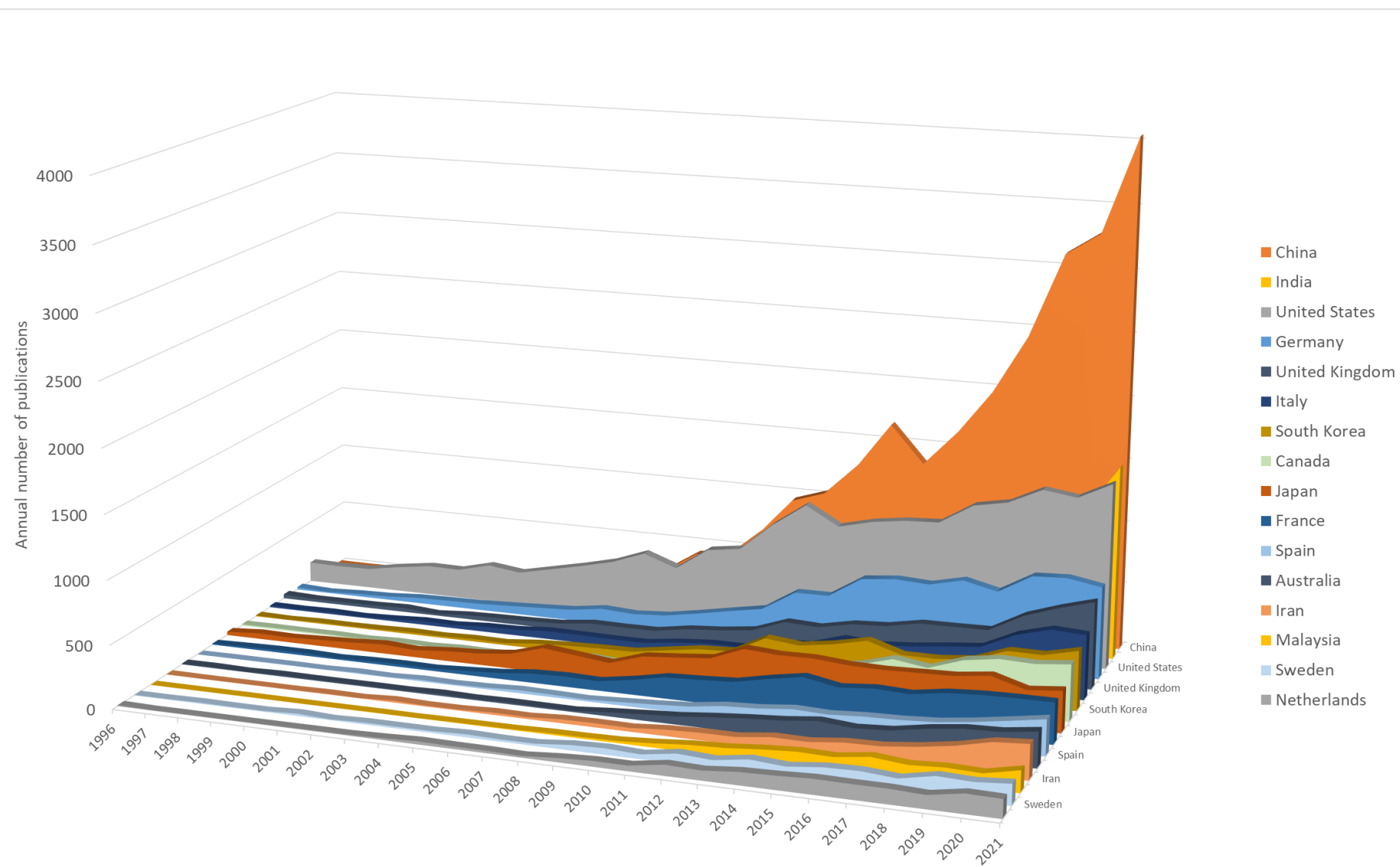
XEV publications top 16 countries (by volume)



2020		
Rank	Share	Country
1	30.3%	China
2	12.4%	United States
3	10.7%	India
4	7.2%	Germany
5	5.7%	United Kingdom
6	4.8%	Italy
7	3.9%	Canada
8	3.7%	South Korea
9	3.0%	France
10	2.8%	Japan
11	2.3%	Iran
12	2.2%	Australia
13	2.2%	Spain
14	1.4%	Netherlands
15	1.3%	Sweden
16	1.0%	Malaysia

(EVS-33 Portland, USA)

XEV publications top 16 countries (by volume)



2021		
Rank	Share	Country
1	31.9%	China
2	12.1%	India
3	11.6%	United States
4	5.8%	Germany
5	5.4%	United Kingdom
6	4.0%	Italy
7	3.7%	South Korea
8	3.5%	Canada
9	2.6%	Japan
10	2.5%	France
11	2.2%	Spain
12	2.2%	Australia
13	2.2%	Iran
14	1.3%	Malaysia
15	1.3%	Sweden
16	1.1%	Netherlands

(EVS-34 Nanjing, China)

Volume and growth

	Publication volume XEV 2016 - 2020	Annual publication volume growth 2016 - 2020 (CAGR)	
		XEV	National
Australia	975	12%	3%
Canada	1,871	6%	2%
China	12,490	16%	9%
France	1,478	4%	0%
Germany	3,594	3%	1%
India	3,530	34%	7%
Iran	847	19%	6%
Italy	1,884	15%	4%
Japan	1,764	-1%	1%
Malaysia	571	2%	5%
Netherlands	599	0%	2%
South Korea	1,705	10%	3%
Spain	880	10%	4%
Sweden	637	6%	2%
United Kingdom	2,289	11%	1%
United States	6,253	5%	1%
World	44,012	10%	3%

Growth calculated using linear regression and a compounded annual growth rate

Citation impact

	Citation impact (FWCI)	
	XEV	National
Australia	2.12	1.60
Canada	2.00	1.48
China	1.32	1.06
France	1.44	1.30
Germany	1.39	1.35
India	0.98	0.87
Iran	1.95	1.08
Italy	1.91	1.46
Japan	1.07	0.94
Malaysia	1.27	1.02
Netherlands	1.88	1.75
South Korea	1.37	1.06
Spain	1.55	1.29
Sweden	1.97	1.65
United Kingdom	2.10	1.55
United States	2.08	1.39
World	1.36	1.00

Growth calculated using linear regression and a compounded annual growth rate

Shares of XEV publications

	XEV share of automotive	XEV share of national	Share of XEV world
Australia	30%	0.18%	2.2%
Canada	41%	0.33%	4.3%
China	43%	0.40%	28.4%
France	32%	0.24%	3.4%
Germany	29%	0.38%	8.2%
India	29%	0.39%	8.0%
Iran	41%	0.28%	1.9%
Italy	32%	0.30%	4.3%
Japan	35%	0.26%	4.0%
Malaysia	22%	0.33%	1.3%
Netherlands	31%	0.19%	1.4%
South Korea	33%	0.39%	3.9%
Spain	29%	0.17%	2.0%
Sweden	25%	0.29%	1.4%
United Kingdom	33%	0.21%	5.2%
United States	30%	0.18%	14.2%

Enabling technologies - indicators

	Publication volume 2016 - 2020	Annual publication volume growth 2016 - 2020 (CAGR)	Citation impact (FWCI)	Share of academic- corporate co- publications	International co- publications (FWIS)
World					
XEV	44,012	10.4%	1.36	6.6%	0.54
Batteries	84,439	11.8%	1.86	4.0%	0.57
Fuel cells	45,221	2.4%	1.30	3.5%	0.57
Electric machines & power electr.	89,374	4.4%	1.05	6.2%	0.49
World	n/a	3.3%	1.00	2.7%	1.00

Enabling technologies - shares

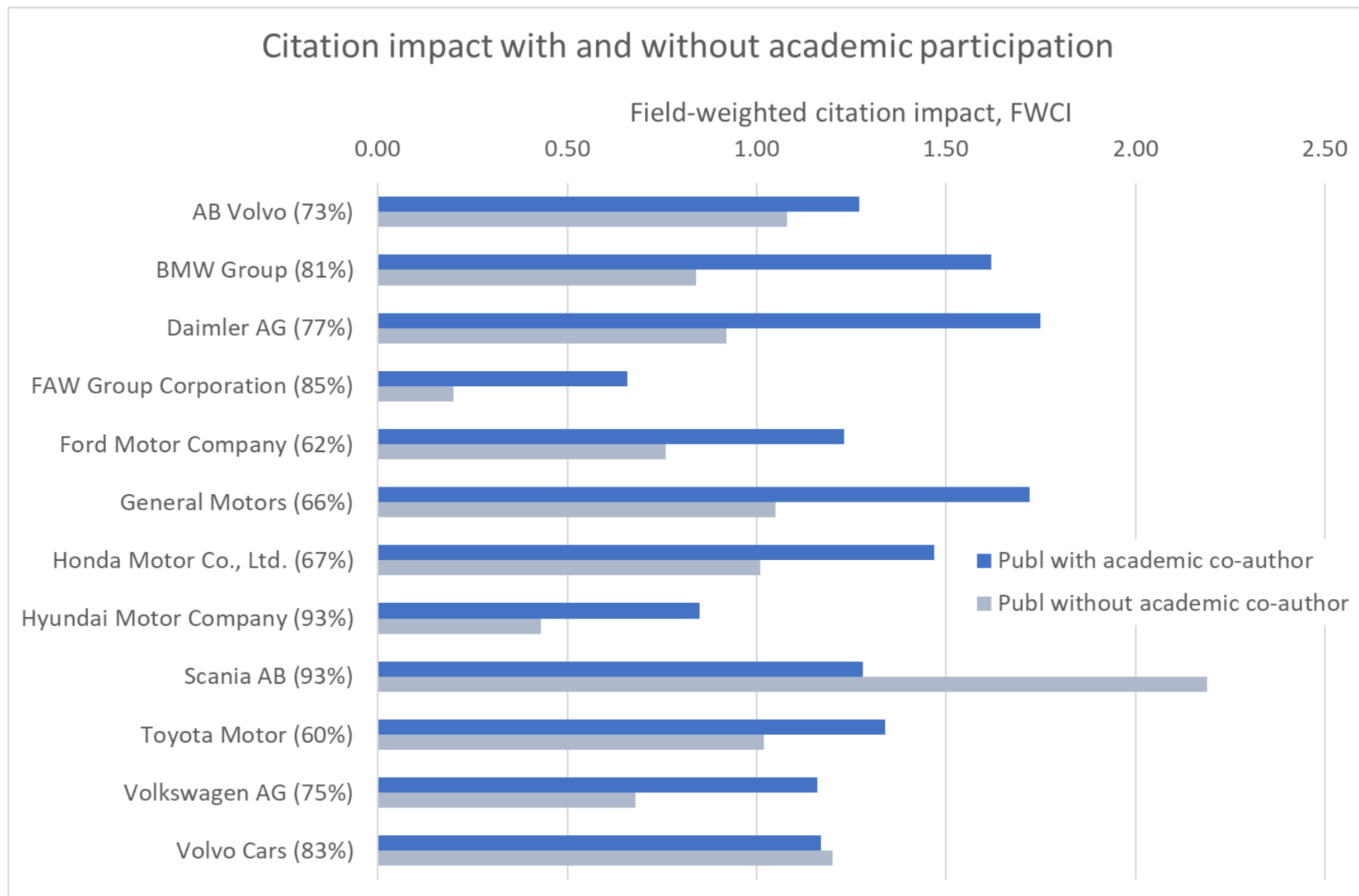
	Share of XEV world	Share of batteries world	Share of fuel cells world	Share of machines world
Australia	2.2%	3.3%	2.2%	1.7%
Canada	4.3%	2.6%	3.5%	2.7%
China	28.4%	47.4%	31.9%	25.2%
France	3.4%	2.4%	3.8%	3.2%
Germany	8.2%	6.0%	5.6%	5.3%
India	8.0%	5.5%	8.6%	12.0%
Iran	1.9%	0.9%	3.6%	2.7%
Italy	4.3%	1.8%	3.5%	3.4%
Japan	4.0%	4.6%	6.3%	4.2%
Malaysia	1.3%	0.8%	2.1%	1.3%
Netherlands	1.4%	0.6%	0.9%	0.6%
South Korea	3.9%	6.9%	6.1%	3.4%
Spain	2.0%	1.8%	2.4%	2.2%
Sweden	1.4%	1.0%	1.1%	0.8%
United Kingdom	5.2%	3.4%	4.4%	4.4%
United States	14.2%	16.9%	12.6%	10.4%

Publications with automakers or suppliers

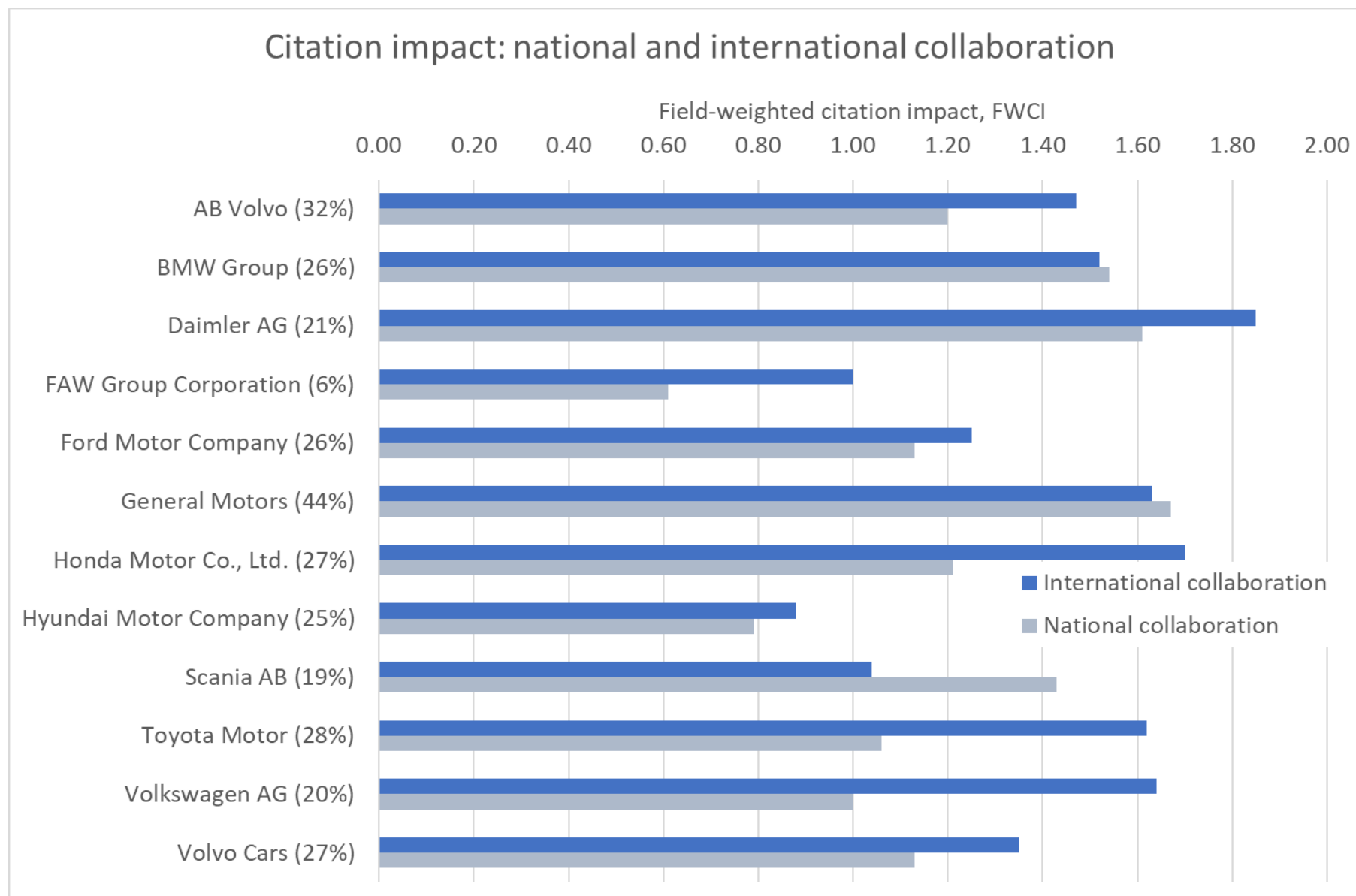
Scopus publications	All		Electrification		Share
2016 - 2020	Volume	Trend	Volume	Trend	electrification
AB Volvo	510	-2.1%	32	-2.5%	6.3%
BMW Group	1,293	7.5%	125	10.3%	9.7%
Daimler AG	1,174	-0.8%	176	6.1%	15.0%
FAW Group Corporation	553	2.7%	48	11.5%	8.7%
Ford Motor Company	2,094	-2.7%	297	0.8%	14.2%
General Motors	1,799	-4.5%	317	-9.2%	17.6%
Honda Motor Co., Ltd.	868	9.7%	85	0.0%	9.8%
Hyundai Motor Company	720	2.5%	124	-2.2%	17.2%
Scania AB	218	-4.7%	23	11.3%	10.6%
Toyota Motor	1,277	-5.0%	280	-9.7%	21.9%
Volkswagen AG	1,638	3.2%	179	-2.9%	10.9%
Volvo Cars	533	1.1%	42	5.9%	7.9%
DENSO Corporation	646	-9.9%	99	-8.9%	15.3%
Robert Bosch GmbH	2,335	3.3%	268	-4.6%	11.5%

Trends calculated using linear regression and a compounded annual growth rate

Academic-corporate collaboration – citation impact



National and international research collaboration



Conclusions

- Publication data shows that vehicle electrification research is developing rapidly and China dominates in absolute and relative terms
- Among enabling technologies, battery research enjoys large and rapidly increasing volumes and a high citation impact
- Toyota has the highest share of vehicle electrification research (among the automakers studied)
- Automakers' research gives higher citation impact if carried out with academic actors and/or with international collaborators