



Karolinska  
Institutet

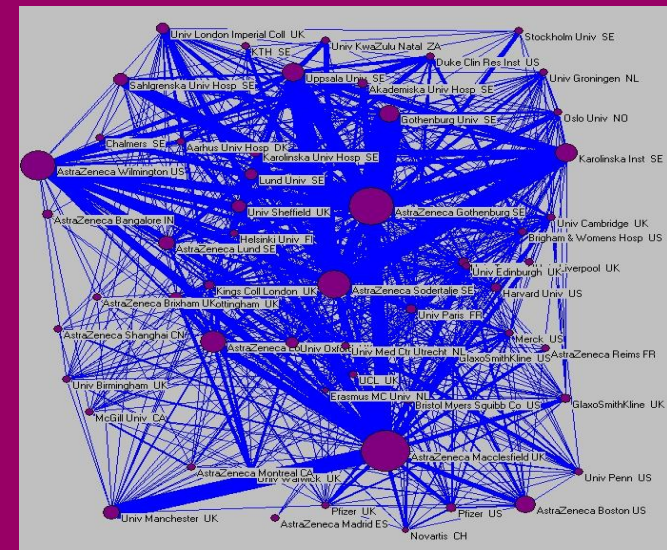
# Mapping external collaborations of big pharmaceutical companies

Francesca Bignami<sup>1</sup>, Anna Sandström<sup>1, 2</sup>, Pauline Mattsson<sup>1, 3</sup>

1 Unit for Bioentrepreneurship, Karolinska Institutet, 171 77 Stockholm, Sweden

2 Vinnova, 101 58, Stockholm, Sweden

3 Sloan School of Management, MIT, Cambridge MA 02142

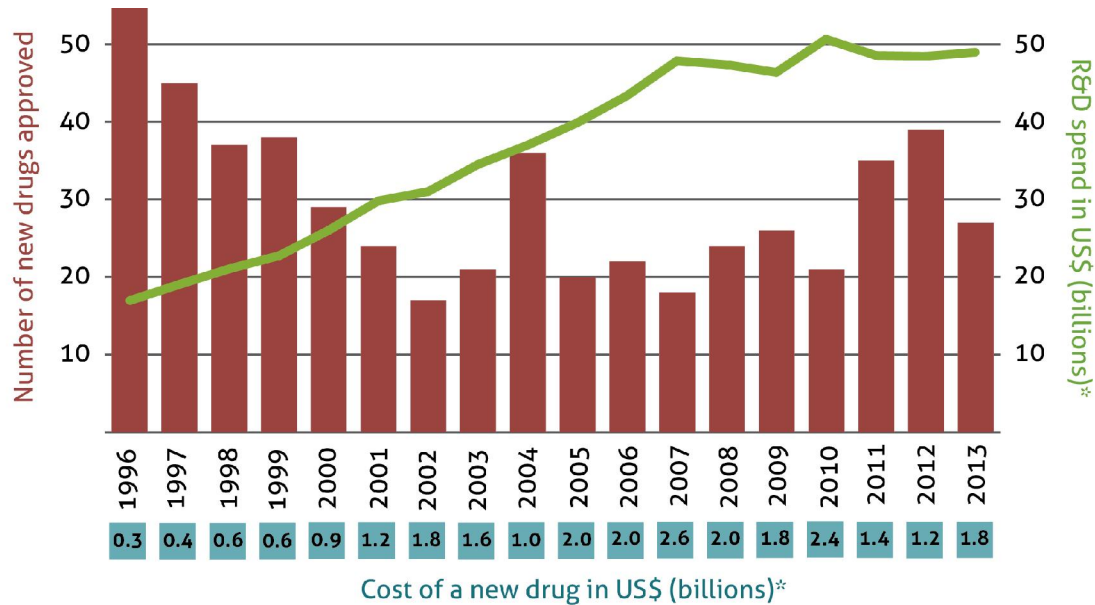


Funding: Ragnar Söderbergs Stiftelse

# Outlines

1. Introduction
2. Open innovation in pharmaceutical companies
3. Aim of the study and research question
4. Methodology
5. Bibliometrical results
6. Bibliometrical results – Geographical Analysis
7. Bibliometrical results – Sector Analysis
8. Bibliometrical result – Social Network Analysis
9. Conclusions
10. Future Research

# Challenges facing pharmaceutical industry



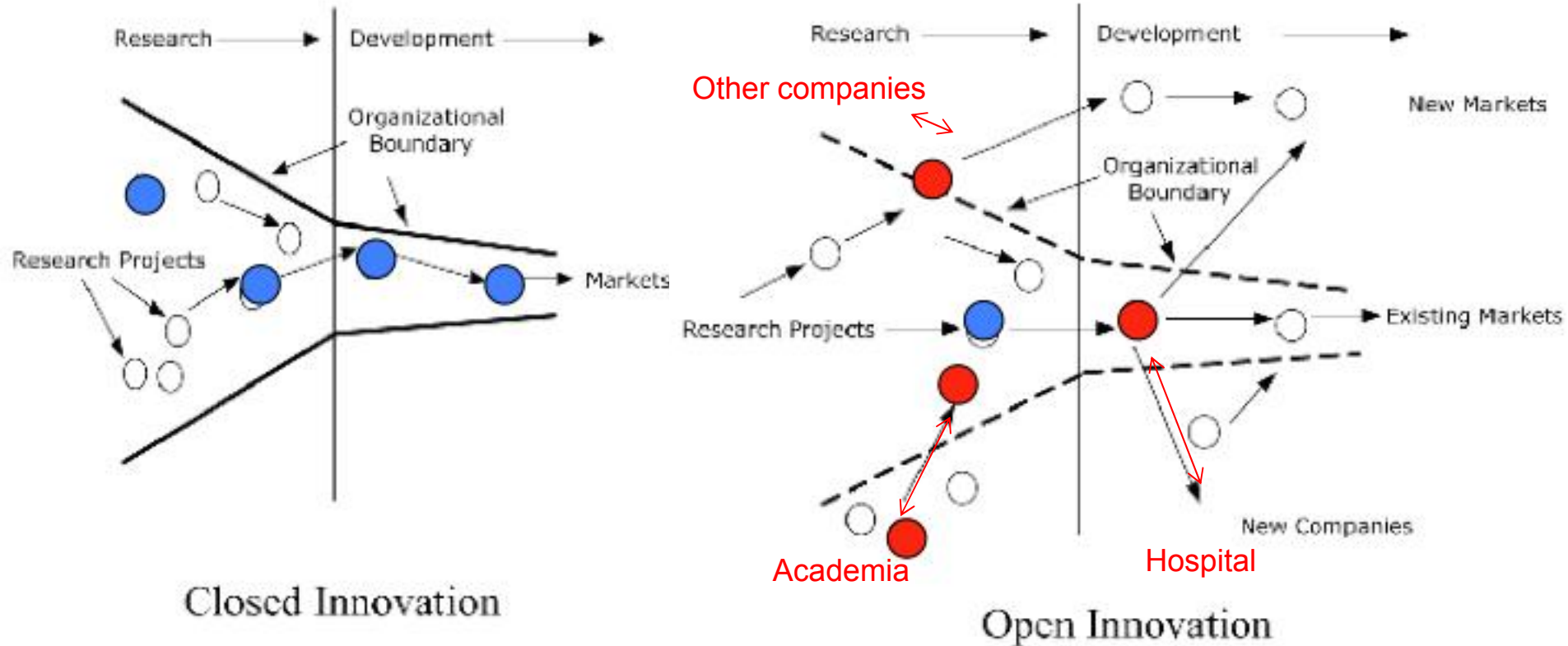
R&D cost ↑  
 No. Drug Approvals ↘  
 Development time ↑  
 Complexity of clinical studies ↑  
 Competition ↑

Data: USFDA, PhRMA

Akshat Rathi | theconversation.com \* New drug cost and R&D spend could be 30% higher if non-PhRMA members are included

Kessel, M. (2011). *The problems with today's pharmaceutical business — an outsider's view*. Nature Publishing Group, 29(1), 27–33.

# Open innovation model in pharmaceutical companies



Chesbrough H. 2003. *Open Innovation*. Harvard University Press: Cambridge, MA

# Aim of the study

Investigate how external research collaborations have developed in six big pharmaceutical companies and contextualize these results with companies' collaboration strategies.

Research question:

Where does the early knowledge of pharmaceutical companies come from?

# Methodology

- Data source: Thomson-Reuter's Web of Science.
- Time period: **2000-2012**
- Population: **6 Multinational pharmaceutical companies**

AstraZeneca 



 NOVARTIS

 gsk  
GlaxoSmithKline



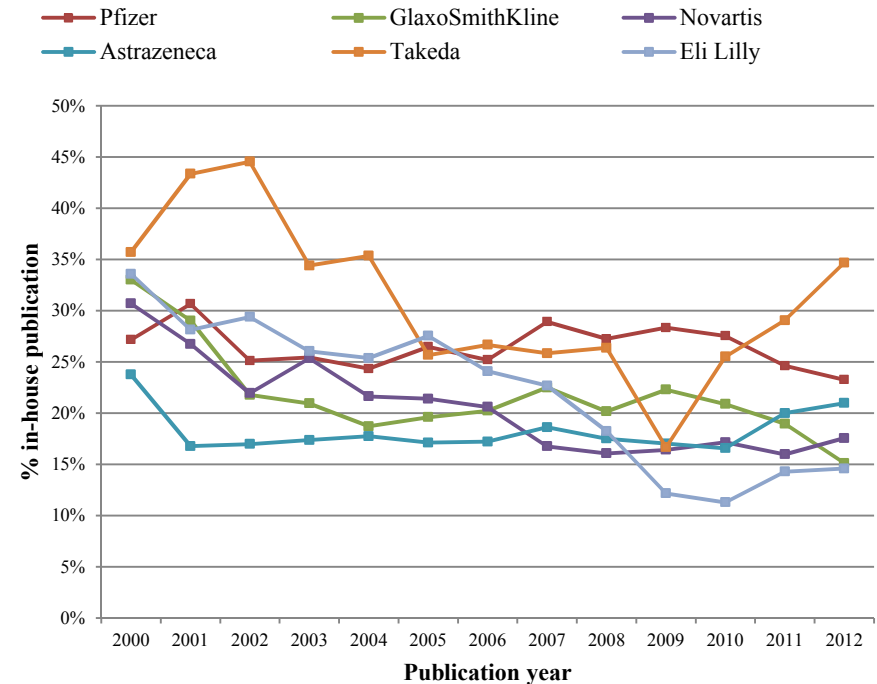
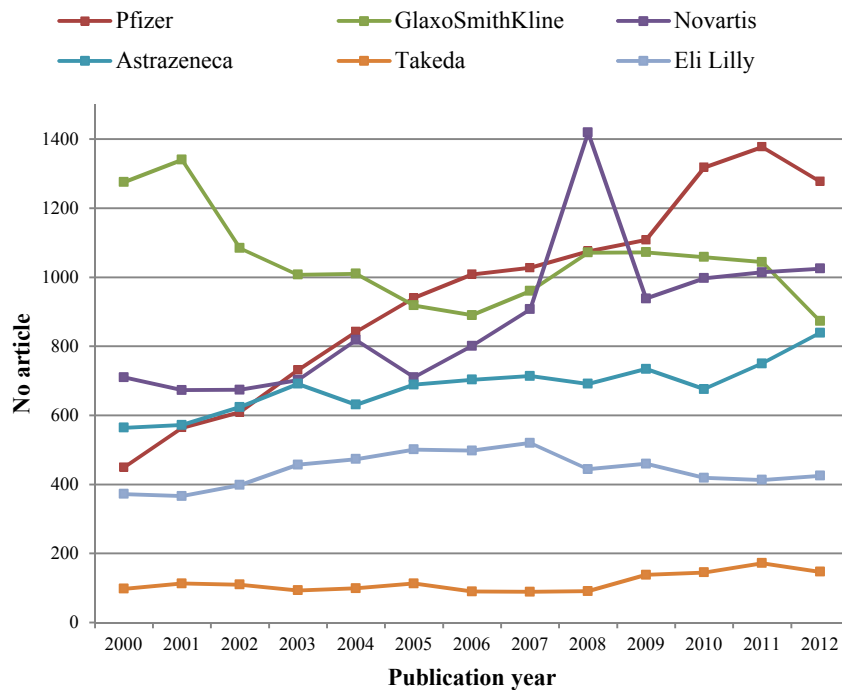


The criteria of selection were :

- Companies using different open innovation models
- Geographical diversity; companies with headquarter in USA, Europe and Asia

# Bibliometrical results

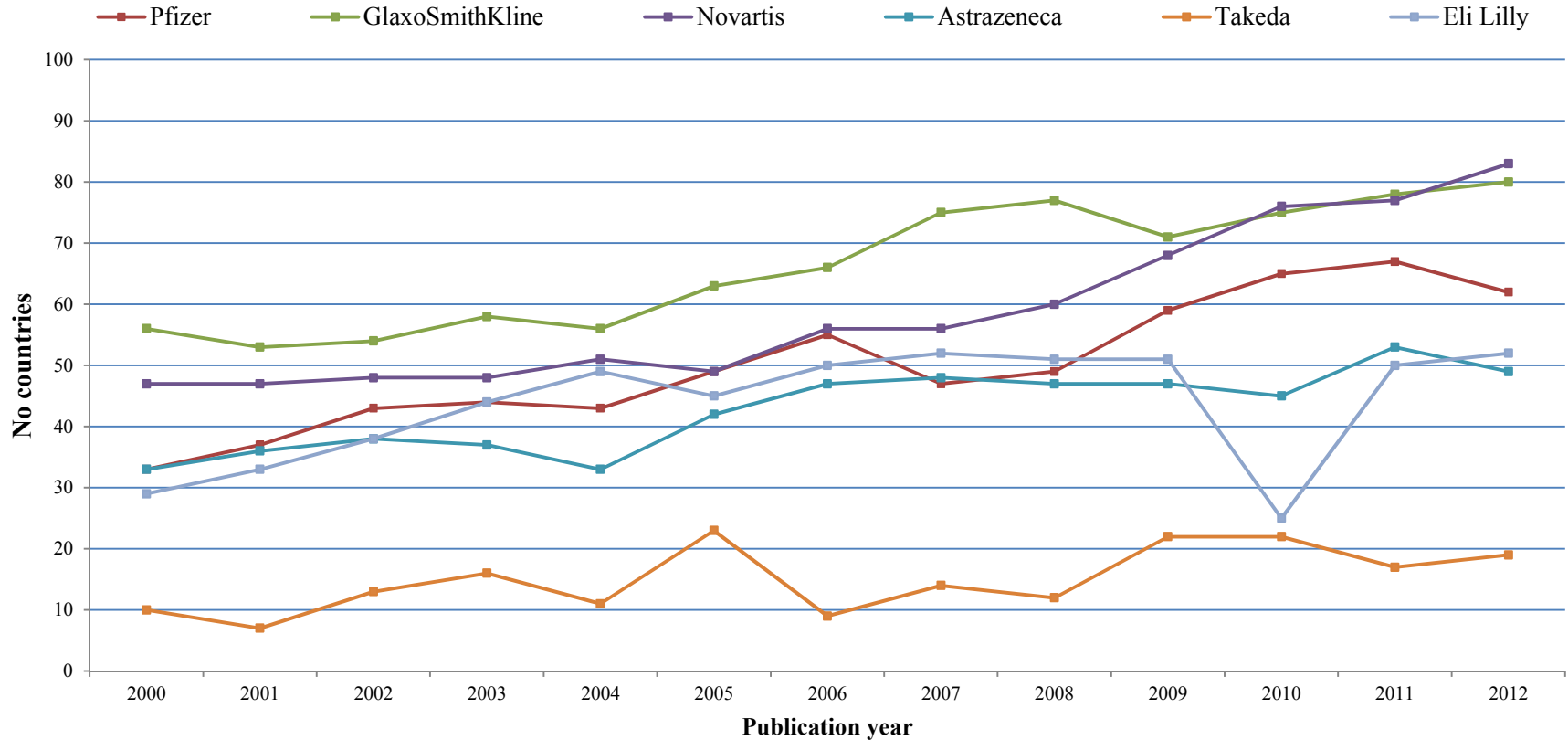
Company	Total pub.	% in-house pub.
Pfizer	12325	26,3%
GlaxoSmithKline	13602	22,3%
Novartis	11388	19,9%
AstraZeneca	8930	18,3%
Eli Lilly	5746	21,3%
Takeda	1498	30,8%



Total publications

% in-house publication

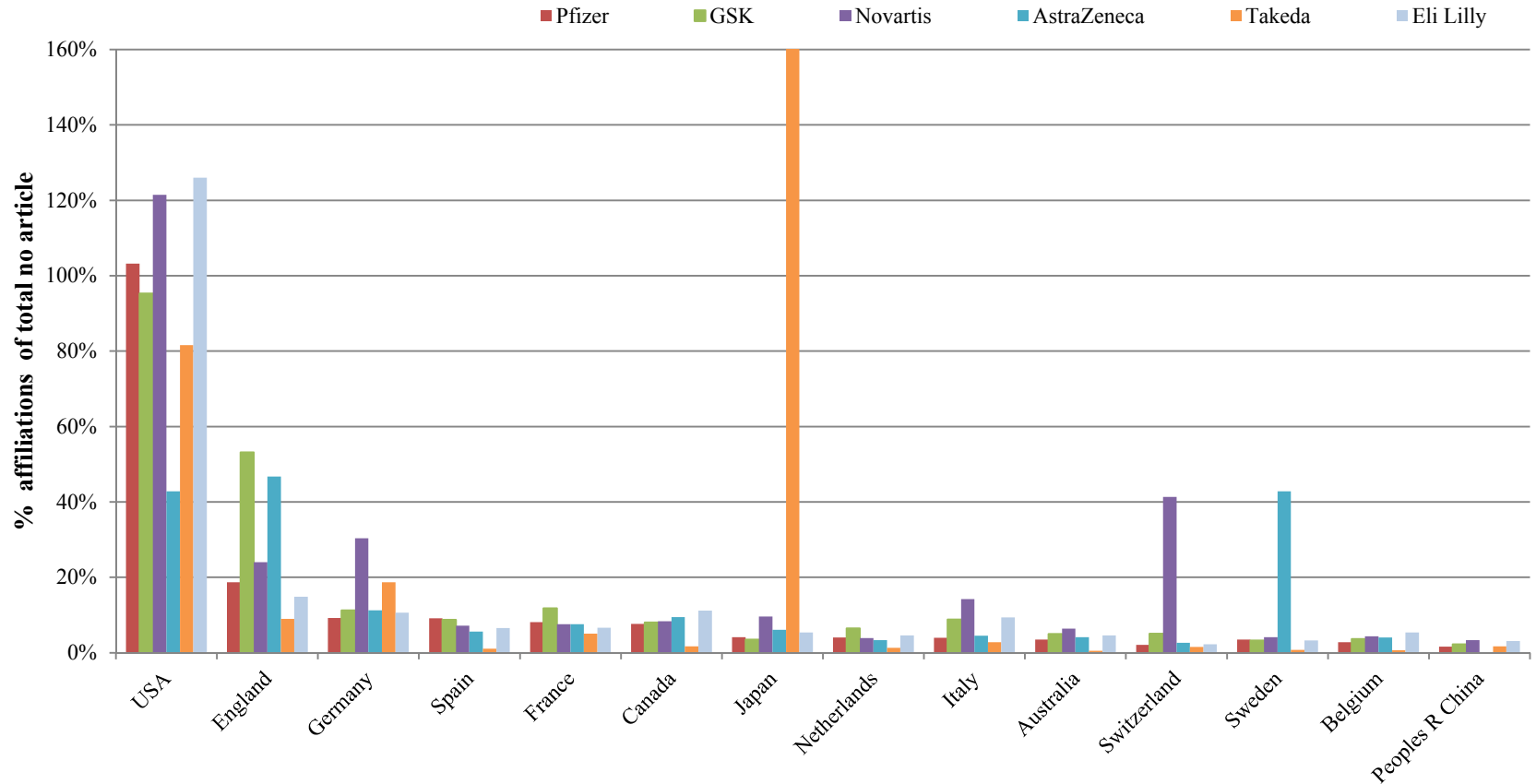
# Geographical Analysis (1)



**Number of different countries in the address of co-authors**



# Geographical Analysis (4)



Share of co-authors in the top 15 countries

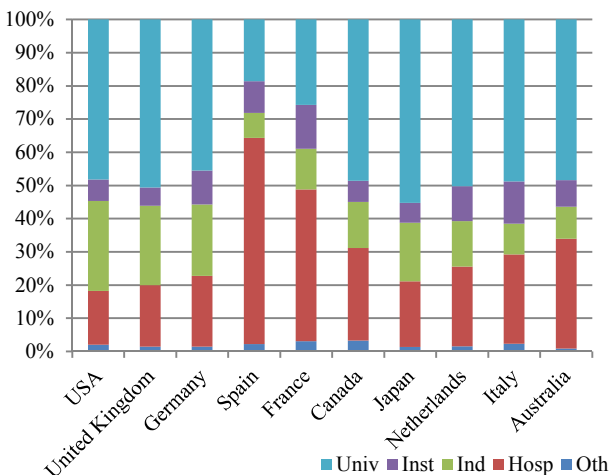
## Sector Analysis (1)

Sector	Pfizer	GlaxoSmithKline	Novartis	AstraZeneca	Takeda	Eli Lilly
University	53,0%	58,4%	61,3%	66,0%	53,1%	56,9%
Hospital	24,8%	28,4%	32,9%	29,1%	23,1%	31,4%
Industry	27,3%	20,5%	22,3%	19,2%	15,8%	24,9%
Institute	12,6%	14,7%	24,0%	11,5%	12,4%	13,1%
Others	5,7%	3,4%	3,6%	3,0%	2,2%	2,9%

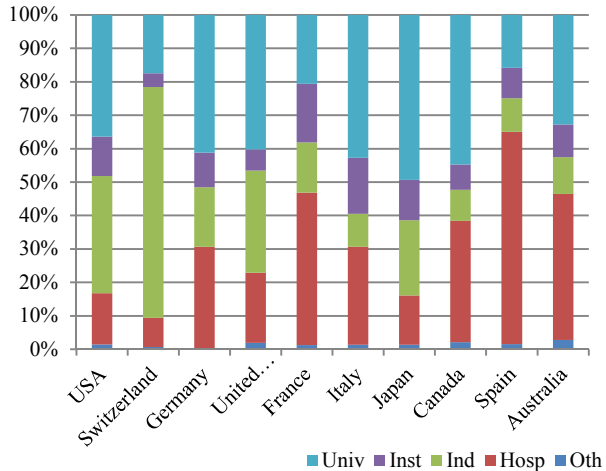
\* % are calculated on the total number of article for each companies.

# Sector Analysis (2)

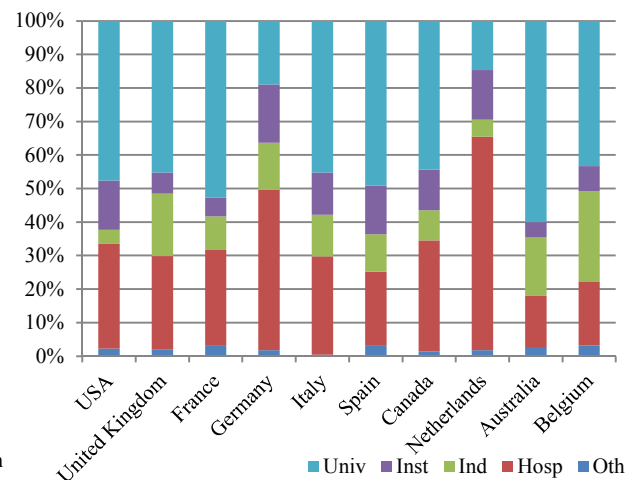
**Pfizer**



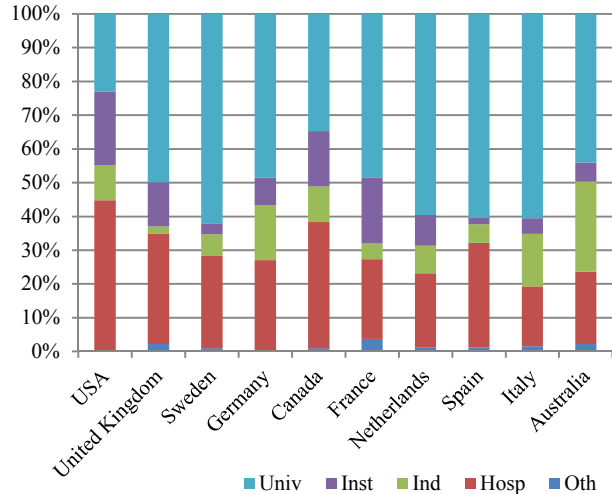
**Novartis**



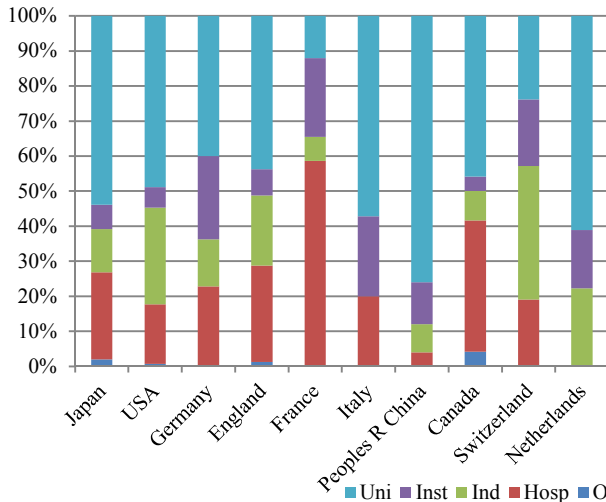
**GlaxoSmithKline**



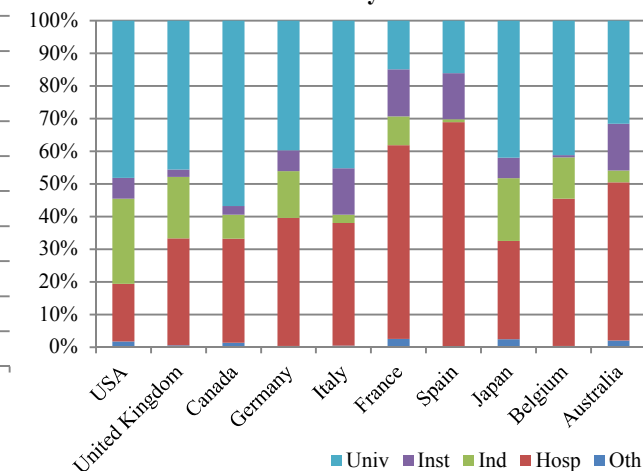
**AstraZeneca**



**Takeda**



**Eli Lilly**



## Frequency of sectors in the top10-countries for each companies

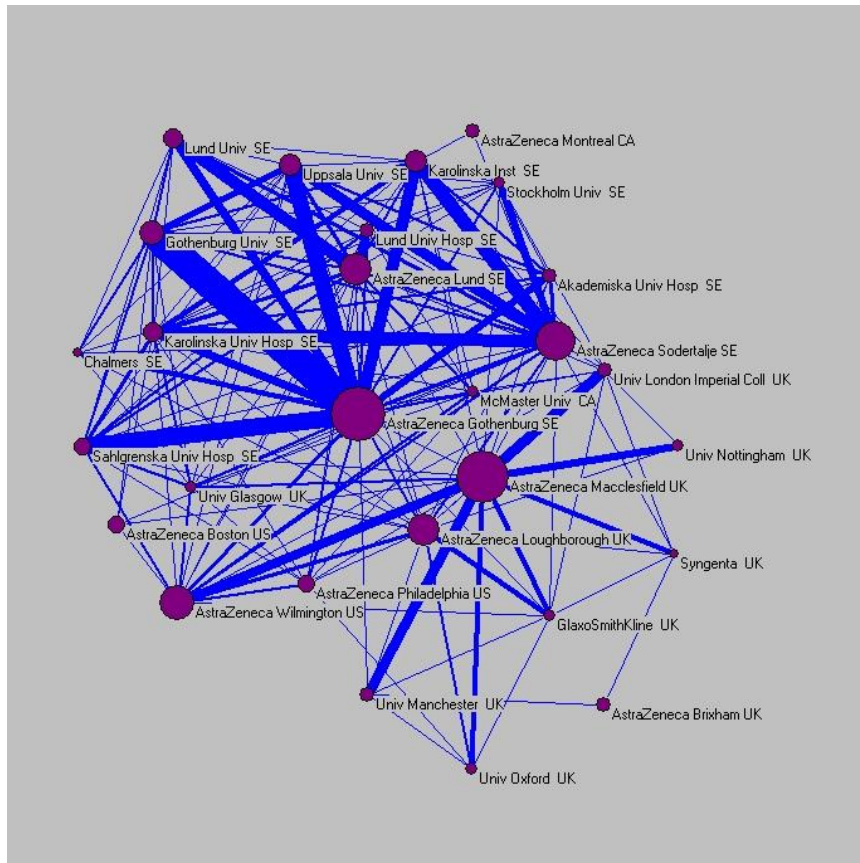
## Sector Analysis (3)

### Top 5 collaborative institutions

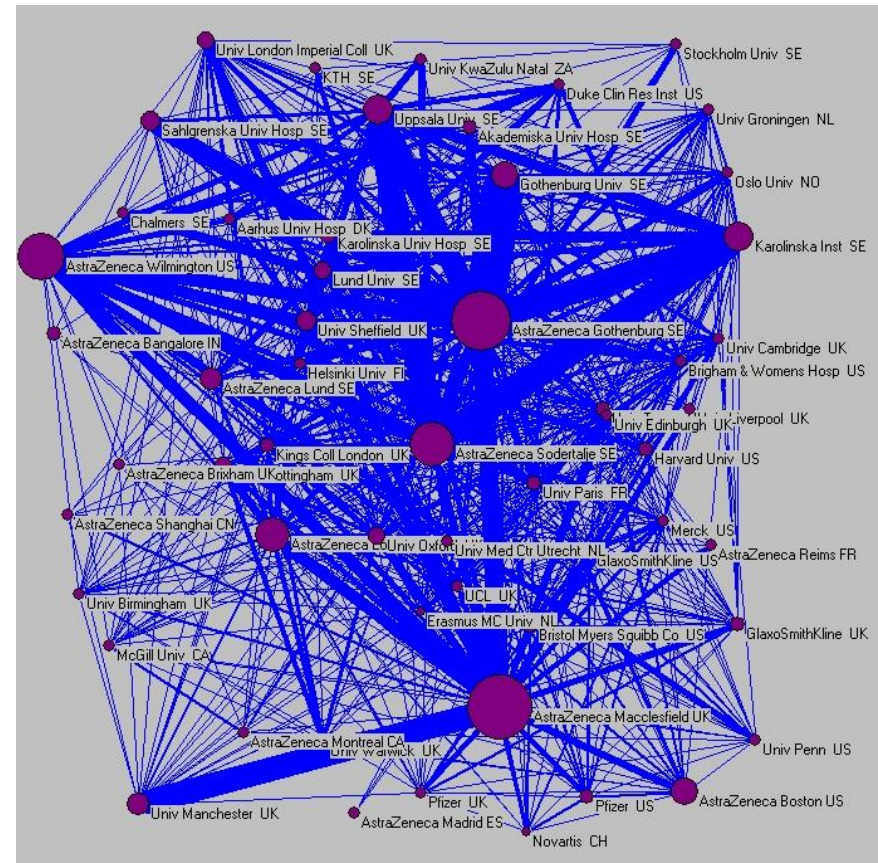
<b>Pfizer</b>		<b>GlaxoSmithKline</b>		<b>Novartis</b>	
Harvard Univ ( <i>Boston, USA</i> )	222	Univ London Imperial Coll Sci & Technol ( <i>London, UK</i> )	380	Scripps Res Inst ( <i>San Diego, USA</i> )	549
Univ Michigan ( <i>Ann Arbor, USA</i> )	213	Univ N Carolina ( <i>Chapel Hill USA</i> )	318	Harvard Univ ( <i>Boston, USA</i> )	411
GlaxoSmithKline	207	Univ Cambridge ( <i>Cambridge, UK</i> )	309	Univ Calif San Diego ( <i>San Diego, USA</i> )	252
Univ Calif San Francisco ( <i>San Francisco, USA</i> )	195	Univ Oxford ( <i>Oxford, UK</i> )	297	Univ Basel ( <i>Basel, Switzerland</i> )	205
Univ Penn ( <i>Philadelphia, USA</i> )	178	Harvard Univ ( <i>Boston, USA</i> )	284	Univ Calif San Francisco ( <i>San Francisco, USA</i> )	165
<b>AstraZeneca</b>		<b>Takeda</b>		<b>Eli Lilly</b>	
Karolinska Inst ( <i>Stockholm, Sweden</i> )	770	Kyoto Univ ( <i>Kyoto Japan</i> )	104	Indiana Univ ( <i>Indianapolis, USA</i> )	333
Uppsala Univ ( <i>Uppsala, Sweden</i> )	470	Univ Tokyo ( <i>Tokyo, Japan</i> )	41	Harvard Univ ( <i>Boston, USA</i> )	206
Gothenburg Univ ( <i>Gothenburg, Sweden</i> )	429	Kyoto Prefectural Univ Med ( <i>Kyoto, Japan</i> )	31	Pfizer	121
Sahlgrenska Univ Hosp ( <i>Gothenburg, Sweden</i> )	283	IKFE ( <i>Germany</i> )	30	Univ N Carolina ( <i>San Diego, USA</i> )	89
Lund Univ ( <i>Lund, Sweden</i> )	276	Osaka Univ ( <i>Osaka, Japan</i> )	29	Univ Calif San Francisco ( <i>San Francisco, USA</i> )	89

# Social Network Analysis

## AstraZeneca



2000-2002



2008-2010

# Conclusion (1)

- **Increase of publications** with external collaborators
- **Decrease of in-house** publications
- **Increase of countries** involved in the publications

## Conclusion (2)

- Companies have different collaboration behaviors:
  - Pfizer high number of industry collaborations → increase in mergers and acquisitions in the company
  - Novartis high number of institute collaborations → strong connection with Scripps Research Institute (La Jolla)
  - AstraZeneca high collaboration rate with Swedish universities → contrast to the strategy of the company to close down R&D centers in Södertälje and Lund
  - Spain and France are important in the co-publication with public sector
  - Switzerland has a high presence of industry organisations
- The creation of small R&D centers in strategic area, in order to work side by side with academia, is reflected with the increase of co-publication with top universities in these towns (Boston and San Francisco).

# Future research

The external collaborations cannot be describe by one single data source.

The results of the bibliometrical analysis will be integrated with:

- **patent analysis**
- **interviews** with companies representative