

Research performance of PhD students and different categories of faculty members at Chalmers University of Technology

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Objective:

The main objective of this study is **to compare scientific performance** in terms of **output, impact** and **collaboration** between **PhD students** and **thee groups of faculties** at Chalmers University of Technology in Sweden.

- a research management strategy that focuses on efficient resource allocation to achieve research excellence and
- to respond and adapt more quickly to international competition and changes

Literature review:

- **What do we know about PhD students' performance, especially in engineering?**
- The evidence is still quite limited.
- Study of all doctoral students in Quebec, Canada, (2000-07; N=27,393) to show their research effort. PhDs contribute to a third of the output of the province, and tend to have significantly lower impact. 40% of all PhDs in Engineering publish at least one paper (Lariviere, 2012).
- Referencing patterns of PhD students to find that PhDs cite more, cite more recent literature on average, and have less self-citations than faculty members (Lariviere, Sugimoto, Bergeron, 2013).
- Stephan's book 'How economics shapes science' (2012) where two chapters are devoted to describe who is doing science and the role of PhD students and Postdocs in the scientific production system in the US.
- Studies consider the publications of PhDs enrolled during the period of time, plus one more year.

Data & Methods:

- WoS articles (articles, reviews, letters) between 2008-2013
- LADOK (employee database) & CPL (publication database)
- Three wide proxies:
 - Number of articles (2008-2013)
 - Inter-institutional collaboration (academia & industry). Intra-institutional collaboration
 - Impact

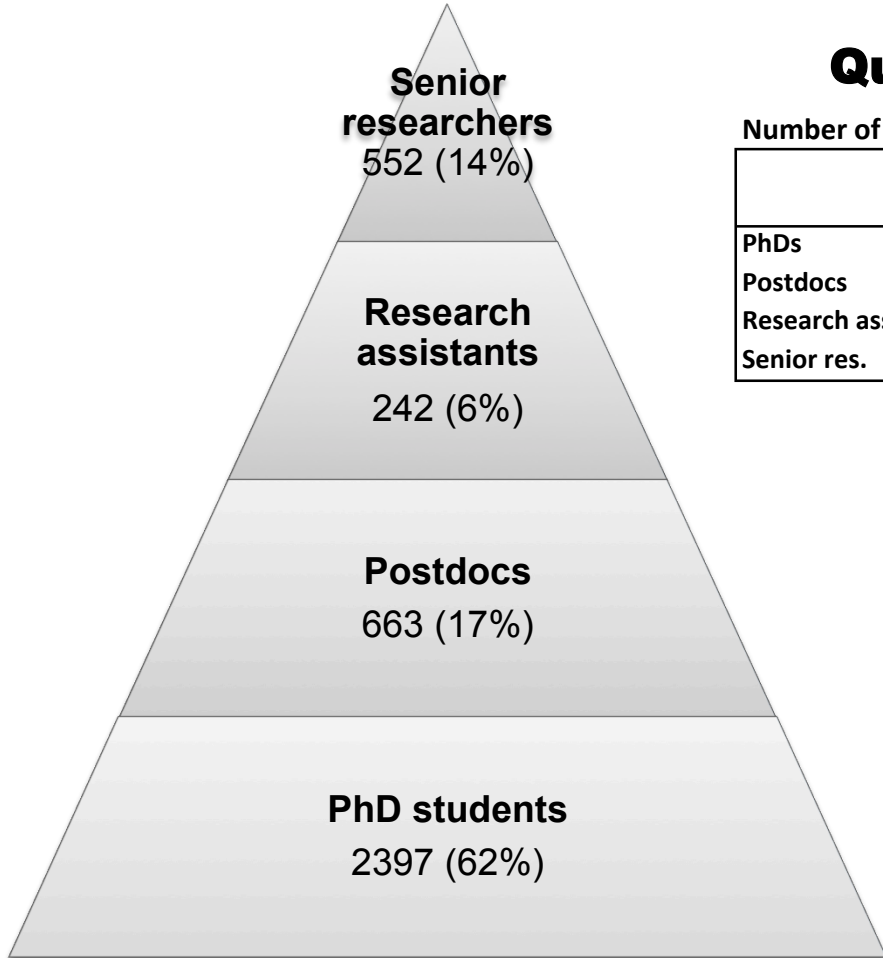
Data & Methods:

- Classification of Chalmers research staff:
 - PhD students
 - All enrolled students in 2013
 - VIVA between 2007-2013 (thesis registered in CPL)
 - Start year 2003 and leaving doctoral studies between 2008-2013
 - Postdocs (2008-2013)
 - Research assistants (2008-2013)
 - Senior researchers (lecturers, assistant professors, professor) (2008-2013)

Data & Methods:

- Classification of publications into the different categories: **based on the first-author**
 - Publications published until the year when the PhD/Postdoc position is completed (+0 year)
 - Publications published until one year after the PhD/Postdoc position is completed (+1 year)
 - Publications published until the year when the PhD/Postdoc position is completed, minus those publications that may belong to another employee category (+0 year-overlap)
 - Publications published until one year after the PhD/Postdoc position is completed, minus those publications that may belong to other employee category (+1 year-overlap)

Results:



Employee distribution – Pyramid structure

Quantity

Number of people across categories

	Totalt	Found in CPL	Num. Of first authors (authors)			
			+0 year	%	+1 year	%
PhDs	2397	2190	902 (1125)	80%	1027 (1267)	81%
Postdocs	663	548	294 (359)	82%	325 (401)	81%
Research assis.	242	234	127 (187)	68%		
Senior res.	552	543	216 (440)	49%		

Number of aticles for first-authors in each category

	+0 year	%	Pub/Per	+1 year	%
PhDs	1745	0,56	0,80	2220	27%
Postdocs	559	0,18	1,02	683	22%
Research assis.	273	0,09	1,17		
Senior res.	563	0,18	1,04		
Total	3140				

PhDs and **Postdocs** are more likely to be **first-authors**.

PhDs are the **first-authors of 56%** of Chalmers publication output

Results:

Inter-institutional Collaboration

Share of articles done in collaboration with international universities or institutes

	+0 year	+1 year	+0 year - overlap	+1 year - overlap
PhDs	31	30	31	30
Postdocs	40	41	43	47
Research assis.	46			
Senior res.	38			

Share of articles done in collaboration with industry

	+0 year	+1 year	+0 year - overlap	+1 year - overlap
PhDs	20	20	20	21
Postdocs	12	13	11	8
Research assis.	13			
Senior res.	8			

PhD students collaborate less with international organisations than the other groups, while Research assistants and Postdocs, to a lesser extent, are the most international groups.

On the other hand, PhD students collaborate with industry as double as much than faculty members.

Results and Discussion:

Intra-institutional Collaboration

Share of articles done in collaboration with other Chalmers departments

	+0 year	+1 year	+0 year - overlap	+1 year - overlap
PhDs	8	9	8	9
Postdocs	9	9	7	6
Research assis.	9			
Senior res.	5			

The collaboration between Chalmers departments is **overall low** across all four categories

Results and Discussion:

Quality & Impact

Average MNCS of the publications in each category

	+0 year	+1 year	+0 year -overlap	+1 year -overlap
PhDs	1,08 (1,00-1,15)	1,06 (1,00-1,13)	1,07 (1,00-1,15)	1,06 (0,99-1,14)
Postdocs	1,29 (1,12-1,48)	1,24 (1,08-1,42)	1,35 (1,12-1,61)	1,45 (1,18-1,74)
Research assis.	1,47 (1,22-1,73)			
Senior res.	1,07 (0,93-1,23)			

Average MNCS of the journals where each category publish

	+0 year	+1 year	+0 year -overlap	+1 year -overlap
PhDs	1,21 (1,16-1,26)	1,18 (1,14-1,22)	1,20 (1,15-1,25)	1,17 (1,13-1,22)
Postdocs	1,34 (1,25-1,44)	1,32 (1,24-1,41)	1,40 (1,28-1,51)	1,46 (1,32-1,62)
Research assis.	1,30 (1,19-1,44)			
Senior res.	1,11 (1,04-1,18)			

Mann-Whitney test suggests that **Post-doctoral researchers** publish significantly **more in higher cited journals**, and obtain **higher citation rates** than **PhD students**.

Postdocs and **Research assistants** publish in **higher cited journals** and are **the most cited groups**.

Discussion :

- PhD students in engineering in Quebec contribute to **30%** of all publications output **vs.** about **55%** of all publications at Chalmers.
- **40%** of PhD students in engineering in Quebec have **at least one publication vs. 47%** of PhD students at Chalmers.
- Both Canadian and (Chalmers) Swedish **PhDs obtain significantly lower citation rates.**
- Authorship of US papers in the journal Science shows that
20% of all authors are PhD students and 22% are postdocs.
26% of articles had a PhD student as first author, and 36% had a postdoc as the first author (95,000 PhDs & 36,500 Postdocs, 2008, USA (Black & Stephan, 2010))
- As the individual scientists progress through different career stages the research performance is more likely to become stronger (Hu, Chen, Liu, 2014)

Conclusion:

- The input of young researchers is key for the development of sciences.
 - PhD – industry, quantity (?)
 - Postdocs – quantity, quality, impact, international collaboration
- More similar studies are necessary:
 - The scientific system is having problems to absorb the newly trained PhDs, and to provide tenure track positions for Postdocs.
 - The design of better research strategies for academic institutions
 - The design of better models to manage and allocate research funds
- Supporting and investing in the right group of people to achieve desired goals and to conduct fair research assessment exercises.



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