

The Impact of National Supercomputing in Denmark

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PLAN-E, Paris, April 19-20, 2018



> **3 national supercomputers were launched in 2014 & 2015**

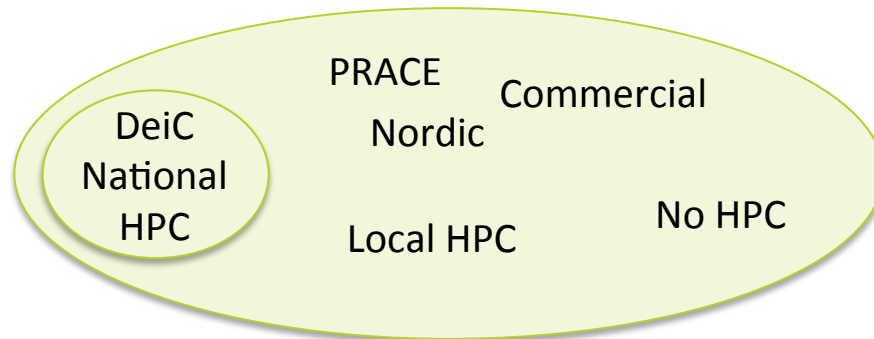
	<i>ABACUS 2.0</i>	<i>COMPUTEROME</i>	<i>KAC</i>
Host/Location	Southern University of Denmark, Odense (SDU)	Technical University of Denmark, Lyngby (DTU)	Royal Danish Library, Aarhus (KB)
Cores Storage	14,000 CPU 1 PB	19,000 CPU 8 PB	<500 CPU 0.1 PB
Access model	Pay-per-use	Pay-per-use Subscription model	Subscription model

> **The Paradigme shift in Denmark & its challenges**

- > Universities: trust on external ownership of compute resources
- > Computing/IT support: slow inclusion of national compute resources
- > Researchers: going from invisibility to visibility of compute resources in their research budgets
- > The 3 hosts of national supercomputers: must ensure fast sustainability due to the short lifetime of HW – 3 pay model approaches:
 - ABACUS: pay per use (up front) – allocation of compute time – (a la the the payment model of PRACE)
 - Computerome: proof-of-concept approach – test – create the job and then pay!
 - Cultural Heritage Cluster: Subscription model with dedicated technical support

- > **However! What is the scientific impact after 3-4 years with national supercomputing in Denmark?**
- > **Bibliographic Landscape**

* Nordic: WLCG Tier-1; Commercial HPC: Amazon, Azure etc.



~ 23,000/year
Total pub. DK
(Forskningsbarometret 2017)

This study:
Peer-reviewed publications that included
ABACUS 2.0 or COMPUTEROME



- Who have Included DeiC National HPC in Danish Peer-Reviewed Research ?
- What can we measure?

List of Projects /
 Researchers using HPC
**DIRECT CONTACT
 TO USERS (Verification)**

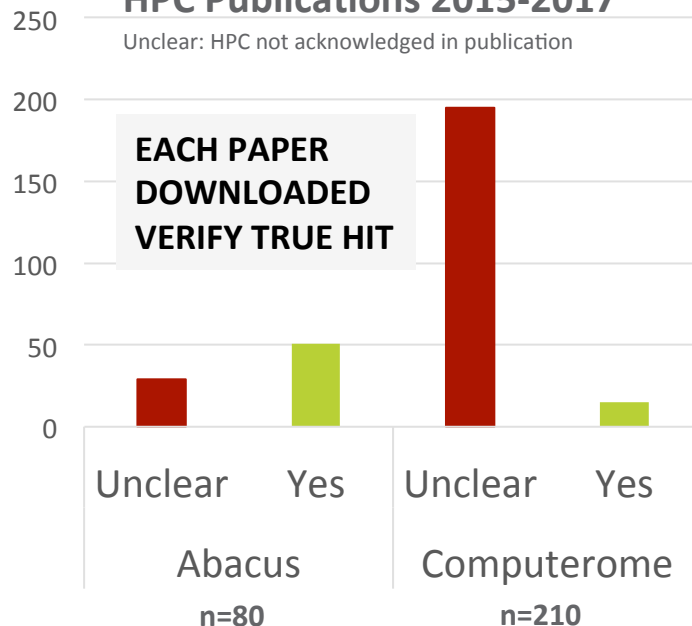
Web of Science

Google Scholar

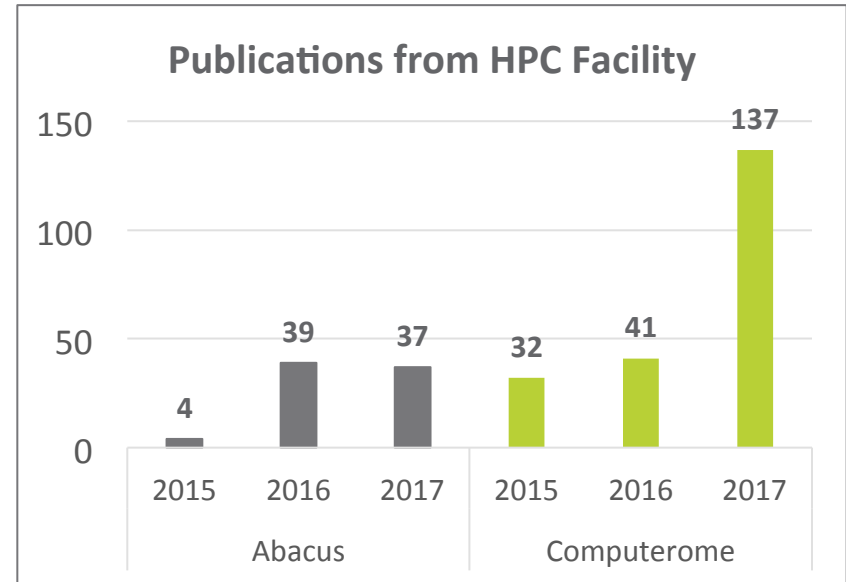
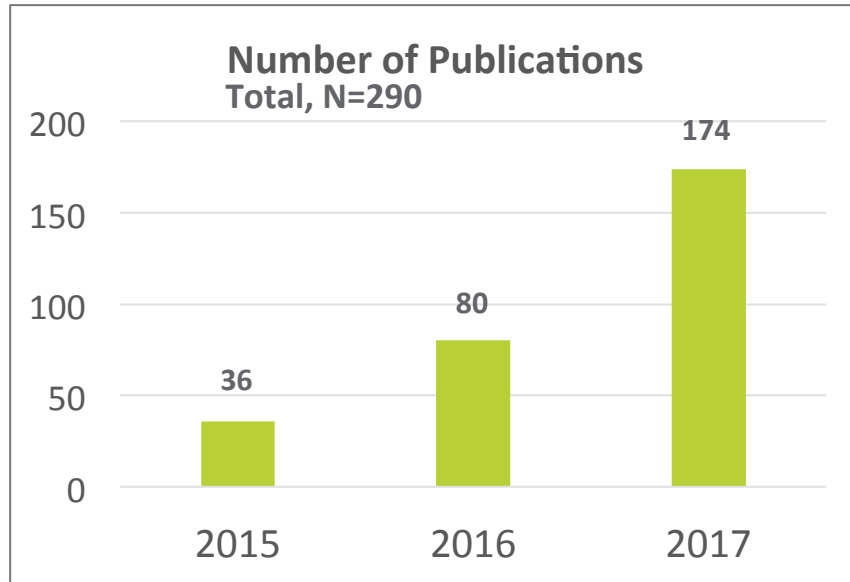


HPC Publications 2015-2017

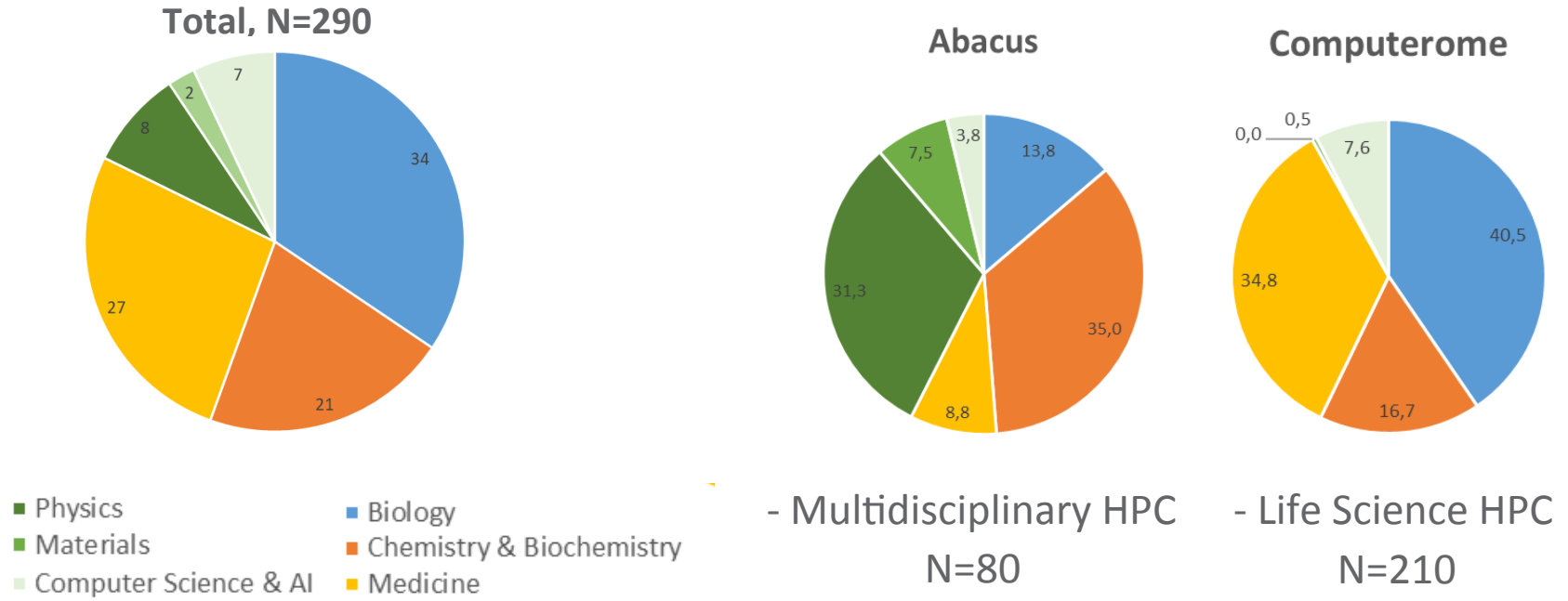
Unclear: HPC not acknowledged in publication



> Scientific Papers – Numbers Doubled Every Year



> Scientific Papers – Category 2015-2017 (% Distribution)



> 290 Scientific Papers in 160 Different Journals !

- Diverse Landscape 😊
- 11% are published in **Nature-Series or Science** in the period 2015-2017 – 2.8% in Nature (n=8).

Factor 10!

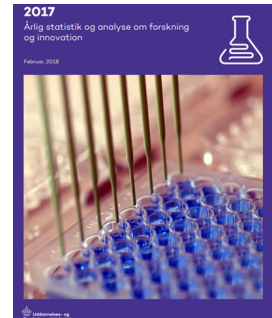
- DK 2012-2016: 195 Nature papers
Corresponds to 0.2% (Total N= 111,805)

Journal for publication that included national HPC	Count	JIF
Nature Reviews Drug Discovery	1	57.000
Nature Biotechnology	1	41.667
Nature Reviews Genetics	1	40.282
Nature	8	40.137
Science	1	37.205
Nature Genetics	4	27.959
Nature Methods	2	25.062
Nature Cell Biology	1	20.060
Nature Structural & Molecular Biology	2	12.595
Nature Communications	9	12.124
Nature Microbiology	2	-
	32	

Artikler med forfattere fra det pågældende land		Artikler per mio. indbyggere		
1	USA	3.675	Island	67,3
2	Storbritannien	1.147	Schweiz	50,0
3	Tyskland	928	Danmark	34,5
4	Frankrig	550	Sverige	23,3
5	Canada	435	Holland	20,9
6	Schweiz	412	Estland	19,8
7	Australien	394	Finland	17,9
8	Holland	354	Storbritannien	17,7
9	Japan	341	Norge	17,0
10	Spanien	277	Israel	16,9
11	Sverige	227	Australien	16,6
12	Italien	225	Østrig	15,9
13	Danmark	195	Belgien	13,6

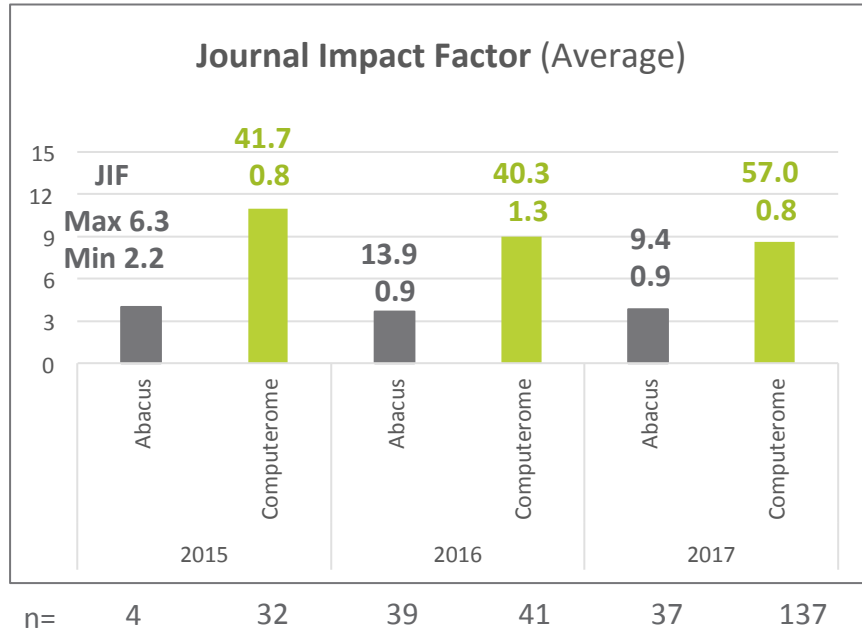
Tabel 2.8

Publikationer i Nature, OECD, 2012-2016



Forskningsbarometeret 2017, side 54
Styrelsen for Forskning og Uddannelse

> Scientific Papers – Ranking (JIF)



Total, N=290

JIF Interval	n Pub	Average JIF in the interval	% Pub
0-2.49	43	2	15
2.5-4.99	117	4	40
>5	130	13	45

- JIF overall range: 0,9-57
- 45% of the HPC publications have a JIF > 5



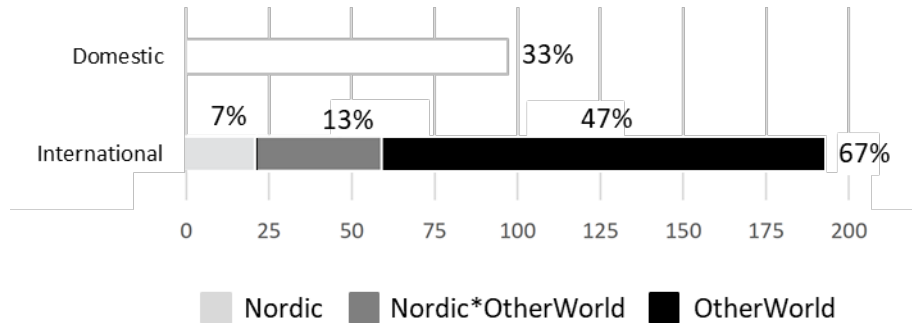
2015-2017 University	(206)* Without National Collaboration	(84)** With National Collaboration	Total
KU	80	76	156
DTU	49	65	114
SDU	72	13	85
AU	1	25	26
ITU	3	0	3
RUC	0	3	3
AAU	1	1	2
CBS	0	0	0

* May include international collaboration or with industry.

** Collaboration with other Danish University

84 publications ** The same publication in this overview figures several times in the counts (4 universities: 4 times.... etc.)

- 67% of the HPC publications included international collaboration

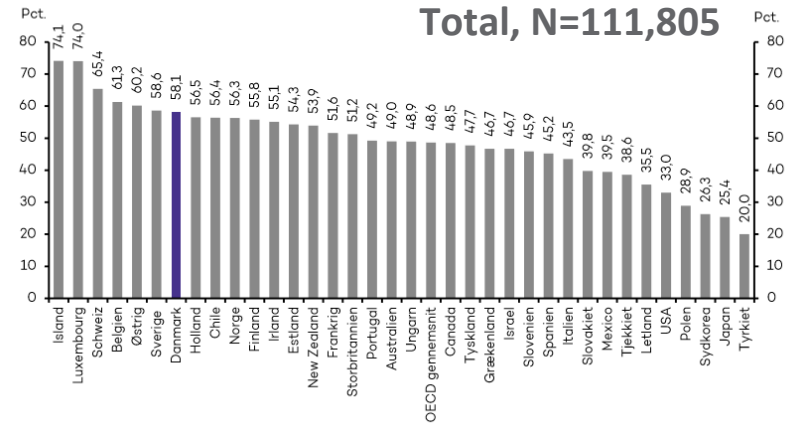


Number of 290 scientific publications that included international collaboration using DeiC National HPC from 2015 to 2017.

- 58% of total DK publications included international collaboration (#7)

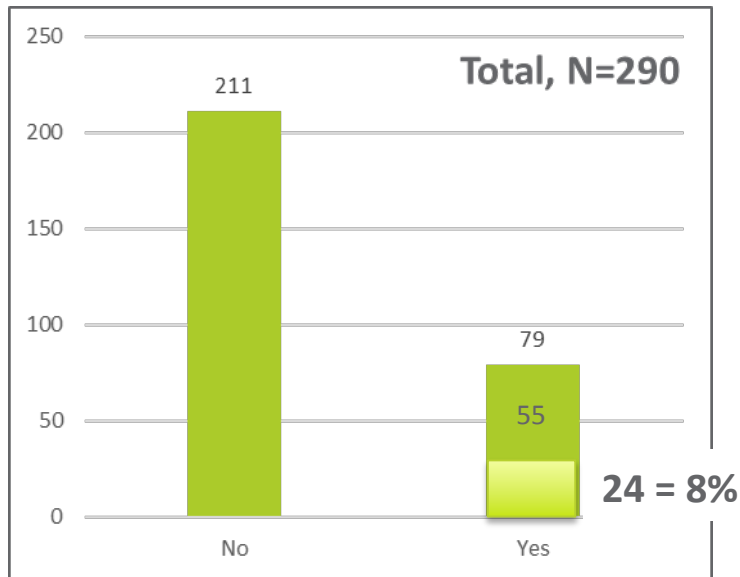
Figur 2.8

Andel af publikationer, som er internationalt sampublicerede, OECD, 2012-2016



Forskningsbarometeret 2017. Årlig statistik og analyse om forskning og innovation, side 58
Styrelsen for Forskning og Uddannelse

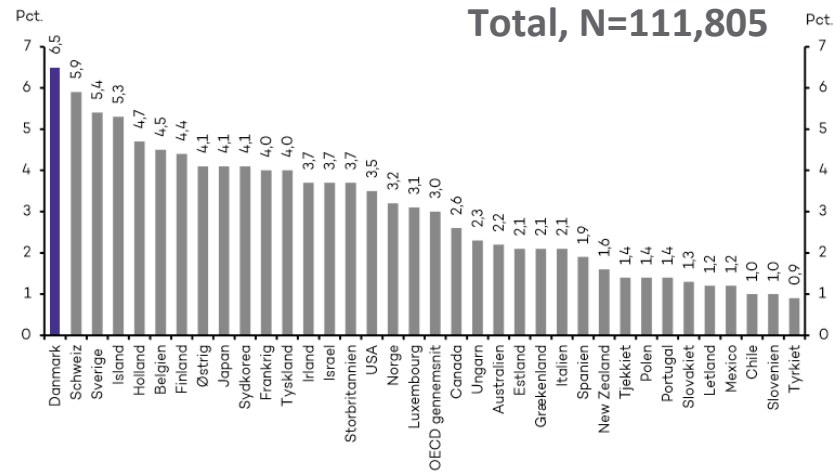
- 8 % of the HPC publications included Industry (27% Incl. Hospitals, SSI)



- 6.5 % of total DK publications included Industrial collaboration (#1)

Figur 2.9

Andel af publikationer, som er sampubliceret med erhvervslivet OECD, 2012-2016

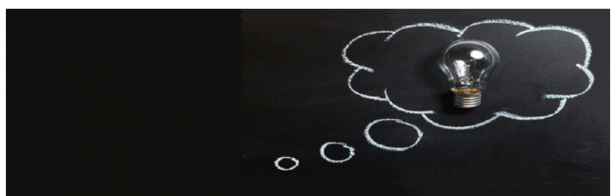


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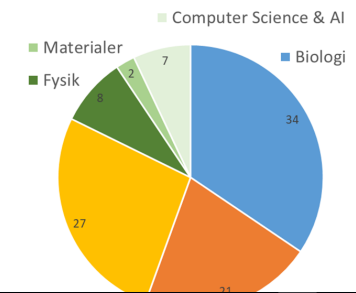
Publikationsliste

Se forskningsresultaterne fra de nationale supercomputere



Denne oversigt tegner et landskab af de videnskabelige publikationer som er afledt af at inkludere regnekraft fra et nationalt HPC-anlæg (Computerome, ABACUS 2.0 og Kulturarvsclusteret). Den %-vise fordeling af videnskabelige HPC publikationer indenfor de angivne fagområder ses i Figur 1 for perioden 2015 til 2017.

- Oversigt over publikationer sorteret efter årstal findes her: [PUB_ÅRSTAL](#)
- Oversigt over publikationer sorteret efter rangering (JIF) findes her: [Kommer snart](#)
- Mangler din publikation på listen? Så kan du registrere den her: [PUB_REGISTRERING](#)
- Har du henvist til brug af national regnekraft i din publikation? [Instruction Acknowledgements](#)



Figur 1. Fordeling (%) af 290 videnskabelige publikationer i perioden 2015 til 2017, der anvendte High Performance Computing (HPC) fra nationale anlæg i DK. Angivelse af forskningsområde for tidsskriftet som der blev publiceret i (Journal Impact Factor Kategori).

Journal Impact Factor (JIF) på f.eks. 3 henviser til at i gennemsnit citeres videnskabelige publikationer fra pågældende tidsskrift 3 gange baseret på data fra de sidste to år. Jo højere JIF for et tidsskrift jo mere videnskabeligt anset er pågældende publikation. Se ovenstående link for lister med publikationer.

Det understreges, at denne liste må anses som værende en "work-in-progress" oversigt

Relaterede nyheder

Sommerkonkurrence indbyder studerende til at lære om supercomputere

COMPUTEROME analyserer nu alt data direkte fra det nye Cryo-Elektron Mikroskop på KU.

Danske universitetsfolk ser seneste nyt fra supercomputerverdenen

Supercomputer sætter fart på kræftforskningen

Se forskningsresultaterne fra de nationale

Relateret indhold

PUB REGISTRERING

Brug af supercomputing - Abacus 2.0, SDU

DeiC Nationale HPC Center, SDU

DeiC Nationale Kulturarvscluster, Det Kgl. Bibliotek

Del dette

📧 EMAIL 📘 FACEBOOK

🌐 LINKEDIN 🐦 TWITTER

National eScience Portal

<https://vidensportal.deic.dk/da/publikationer>

Registration of Scientific Publications that Included the use of DeiC National High Performance Computing (HPC)

Example to file:

Stella, S. et al. (2017) Structure of Cpf1 endonuclease R-loop complex after target DNA cleavage. *Nature*, 546 (7659) 559-563. DOI: 10.1038/nature22398.

First author *

(Ex. Stella, S. et al.)

Year *

(Ex. 2017)

Title * This is a required field

(Ex. Structure of Cpf1 endonuclease R-loop complex after target DNA cleavage)

Journal name *

(Ex. Nature)

Volume

(Ex. 546)

Issue

(Ex. 7659)

Pages

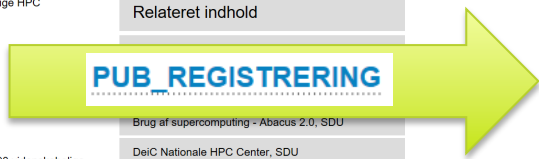
(Ex. 559-563)

DOI *

(Ex. 10.1038/nature22398)

Article

Attach article
Filer skal være mindre end 2 MB
Tilføjde filtype: pdf



> Conclusions

- High ranking/quality science have used national supercomputing
- The research that included DeiC national HPC had a higher rate of publications in "Nature" compared to the overall DK analysis in "Forskningsbarometret 2017"
- The HPC-architectures reflect the intended strategical vision on scientific distribution
Abacus: Multidisciplinary -- **Computerome:** Life Sciences
- High degree of collaboration (National, International, Industry) – Competence sharing
- WHO – 290 publications: <https://vidensportal.deic.dk/da/publikationer>
- Conf paper: "National Supercomputing in Denmark", MIPRO2018

- > **What have we learned throughout the process of integrating national supercomputing in Denmark**
- > 3 financial independent national supercomputing facilities, have resulted in 3 different access & support points, 3 different payment models, 3 different success rates
- > DeiC works with virtual and part time/free commitment, i.e. small in staff – large in network – hence slow processes, however, aligned and strong in engagement into target communities throughout our 8 universities
- > New and inexperienced HPC users should have free access in order to inspire young researchers and integrate awareness and skills
- > It is a low-cost model approach – sustainability without continuous national funding is an issue!