Danish Maritime Research 2008–2017

Executive Report

Danish Shipping
March 2019
This Executive Report was prepared by DAMVAD Analytics for Danish Shipping. The project was carried out with support from the Danish Maritime Fund. The main report can be downloaded from www.danishshipping.dk.

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Danish Maritime Research
2008–2017

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Introduction

This report, prepared by DAMVAD Analytics, presents the results of a major analysis of the position, development and funding of Danish maritime research from 2008 to 2017.

The review provides a combined overview of:
- Danish maritime research and collaboration projects
- The knowledge stronghold of Danish maritime research
- The funding of Danish maritime research

The final reporting comprises this executive report and a main report which reviews the results in more detail and puts them into perspective by involving key players in the Danish maritime sector. The main report can be downloaded from www.danishshipping.dk.
Three main results pointing towards the future

The position of Danish maritime research is strong, but it is under growing pressure.

Danish maritime research holds high international standards and is positioned 49% above the OECD average.

Denmark’s leading position in terms of several key strengths is being increasingly challenged by strong international competitors.

Actors in the sector are calling for keener focus on the sector’s future request for R&D in IT, digitisation and other areas.

R&D networks are crucial but must be more market-oriented.

57% of the sector actors surveyed are involved in R&D projects funded by public research programmes.

The sector is calling for better knowledge dissemination and networks, focused on presenting relevant expertise of the research community to the business community.
Danish maritime research is under-funded.

The business community and private foundations fund the vast majority of maritime research in Denmark.

Relatively few public strategic funds or programme funds are allocated to maritime research, compared to other research areas in Denmark. And a number of Nordic countries are allocating more public R&D funds towards maritime research.
The Danish maritime sector is characterized by

- A large number of service and technology firms;
- A few large shipping companies and a larger number of smaller firms;
- Nationwide collaboration between universities and the business community.
Danish actors in the maritime sector comprise a handful of large shipping companies and a vast undergrowth of small, well-established technology firms.

Enterprises broken down by size

Breakdown of the maritime sector

Source: DAMVAD Analytics, 2018
Widespread cooperation between public and private players throughout Denmark

Source: DAMVAD Analytics & Scopus, 2018
57% of the firms in the Danish maritime sector participate in R&D projects.

475 out of a total of 833 identified actors in the maritime sector are involved in research.

Source: DAMVAD Analytics & Scopus, 2018
1,287 Publications
A total of **1,287** publications were published by Danish companies and research institutions between 2008 and 2017.

- The number of publications per year grew rapidly up to 2015, after which the number of new publications stabilised at 180 per year.
- The growth in the volume of maritime research exceeds the overall increase in the number of Danish publications in all research areas by a factor of 1.4.
- This increased volume of research is explained by the influx of new research environments and research topics.

![Graph showing developments in Danish maritime research, 2008–2017](Image)
Danish maritime research publications are cited 49% more than a corresponding maritime publication from an OECD country.

Publications in Maritime HR have the greatest impact, being cited more than twice as frequently as the OECD average.

Source: DAMVAD Analytics & Scopus, 2018

Note: The shaded areas indicate a low volume of research; therefore, the impact calculation is subject to greater uncertainty.
Denmark has position of knowledge strength in 6 fields of maritime research

The analysis of Danish maritime research has identified 14 different areas of research, all of which are directly related to the maritime environment.

Six of the fourteen fields of research are deemed primary positions of knowledge strength, as all are characterised by having a scientific impact of more than 1.5 and a high volume of publication.

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Source: DAMVAD Analytics & Scopus, 2018
Specialisation of Danish universities in maritime knowledge strongholds

- Denmark’s primary knowledge strongholds represent the universities’ focus on different fields of research.
- Research activities have traditionally been concentrated at technical colleges and universities, but developments in Denmark’s maritime research have prompted an influx of more institutions and an increase in the number of active researchers.

<table>
<thead>
<tr>
<th>Eco-friendly, energy-efficient shipping, ship tech. &amp; systems</th>
<th>Maritime economics and business</th>
<th>Maritime logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTU</td>
<td>No.: 74 (16%)</td>
<td>DTU</td>
</tr>
<tr>
<td>AU</td>
<td>No.: 27 (27%)</td>
<td>AU</td>
</tr>
<tr>
<td>AAU</td>
<td>No.: 23 (11%)</td>
<td>SDU</td>
</tr>
<tr>
<td>KU</td>
<td>No.: 18 (15%)</td>
<td>CBS</td>
</tr>
<tr>
<td>SDU</td>
<td>No.: 14 (10%)</td>
<td>AAU</td>
</tr>
<tr>
<td>CBS</td>
<td>No.: 4 (19%)</td>
<td>KU</td>
</tr>
<tr>
<td>ITU</td>
<td>No.: 0 (0%)</td>
<td>ITU</td>
</tr>
</tbody>
</table>

Research specialisation of universities in fields that are primary knowledge strongholds: percentage of all publications per institution and their rank in the field
<table>
<thead>
<tr>
<th>Maritime HR</th>
<th>Other (offshore)</th>
<th>Wind &amp; wave (offshore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDU</td>
<td>No.: 35 (26%)</td>
<td>KU</td>
</tr>
<tr>
<td>KU</td>
<td>No.: 3 (3%)</td>
<td>DTU</td>
</tr>
<tr>
<td>DTU</td>
<td>No.: 3 (1%)</td>
<td>SDU</td>
</tr>
<tr>
<td>AAU</td>
<td>No.: 2 (1%)</td>
<td>AU</td>
</tr>
<tr>
<td>CBS</td>
<td>No.: 2 (10%)</td>
<td>AAU</td>
</tr>
<tr>
<td>AU</td>
<td>No.: 1 (1%)</td>
<td>CBS</td>
</tr>
<tr>
<td>ITU</td>
<td>No.: 0 (0%)</td>
<td>ITU</td>
</tr>
</tbody>
</table>

Source: DAMVAD Analytics & Scopus, 2019
Danish researchers have published in collaboration with more than 1,000 different international institutions.

The most important partner institutions and countries for Danish researchers:

- National Renewable Energy Laboratory
- University of California
- University of Texas
- NTNU
- SINTEF Ocean
- Institute of Maritime Research
- Chalmers University of Technology
- TU Delft
- Ghent University
- CNR, Italy
- National Technical University of Athens
Top 10 countries in terms of no. of publications

- Norway (176)
- United Kingdom (134)
- USA (133)
- Germany (101)
- Italy (59)
- The Netherlands (57)
- France (53)
- Spain (43)
- Sweden (65)
- China (45)

Source: DAMVAD Analytics & Scopus, 2018

Note: Denmark does not cooperate with countries depicted in grey.
Denmark is ranked **sixth** in terms of research production, but it is ranked a definite **first** in terms of scientific impact.

<table>
<thead>
<tr>
<th>Country</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>1.35</td>
</tr>
<tr>
<td>Finland</td>
<td>1.19</td>
</tr>
<tr>
<td>Greece</td>
<td>1.29</td>
</tr>
<tr>
<td>Denmark</td>
<td>1.49</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>1.30</td>
</tr>
<tr>
<td>South Korea</td>
<td>0.74</td>
</tr>
</tbody>
</table>

**Number of Danish publications compared to research production in comparable maritime countries, 2008–2017**
Norway
Impact: 1.14

Germany
Impact: 1.23

China
Impact: 0.51

Source: DAMVAD Analytics & Scopus, 2018
Denmark’s leading maritime research position is challenged

For years, the Netherlands and Finland has experienced growth in scientific impact. Both countries surpassed Denmark’s level in 2017.

Both China and South Korea have a volume of research that is far greater than Denmark’s, and on the field of maritime research they should be expected to be strong competitors to Denmark and other classic maritime countries.
1.5% of the Danish public research budget is allocated for the maritime sector.
Danish maritime research receives 1.5% of the public research budget.

The total investment in Danish maritime research from the public and private sectors amounted to DKK 2,212 million in 2017. 11% of the investment came from public sources, while EU funding amounted to 3%.

Compared to neighbouring countries Norway and Finland, public Danish investments in maritime research are lower by factors of 2 and 1.5 respectively.

Funding of Danish maritime research, 2017

Source: DAMVAD Analytics, Statistics Denmark, annual reports from private funds and foundations, Cordis, Interreg Baltic Sea, Ministry of Transport, Building and Housing, and DAMVAD Analytics’ interaction database, 2018.
The maritime sector receives far less public funding than other sectors such as energy technology or life sciences.

The maritime sector:
> generates one-third more revenue than life sciences;
> exports three times as much as the energy technology sector.

Nevertheless, life science and energy technology receive up to twenty times more public research funding.

<table>
<thead>
<tr>
<th>2017</th>
<th>Maritime sector</th>
<th>Energy technology</th>
<th>Life sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research programmes</td>
<td>DKK 73 million</td>
<td>DKK 449 million</td>
<td>DKK 1,420 million</td>
</tr>
<tr>
<td>In-house R&amp;D investment</td>
<td>DKK 1.87 billion</td>
<td>DKK 3.54 billion</td>
<td>DKK 16.0 billion</td>
</tr>
<tr>
<td>Exports</td>
<td>DKK 232 billion</td>
<td>DKK 85 billion</td>
<td>DKK 107 billion</td>
</tr>
<tr>
<td>Employment</td>
<td>59,692</td>
<td>56,400</td>
<td>47,330</td>
</tr>
<tr>
<td>Revenue</td>
<td>DKK 315 billion</td>
<td>DKK 127 billion</td>
<td>DKK 211 billion</td>
</tr>
</tbody>
</table>

Sources: Please refer to the main report "Danish Maritime Research, 2008–2017", which can be downloaded from www.danishshipping.dk
Positive trend in Blue Denmark’s in-house R&D investment

- The maritime sector’s in-house R&D investment grew 26% more than the combined in-house R&D investments of the Danish business community.
- The sector’s growth in in-house investment is primarily found among the sector’s technology providers.

Trend in the business community’s expenditure for in-house R&D, DKK m

Source: DAMVDA Analytics, 2019, based on Statistics Denmark.
Finnish research institutions and enterprises receive 50% more funding, and Norway funds twice as much maritime research as Denmark.

**Funding of maritime research in Scandinavia (amount compared to Denmark)**

- **Sweden**
  - DKK 179 million
- **Denmark**
  - DKK 254 million
- **Finland**
  - DKK 381 million
- **Norway**
  - DKK 533 million
