Understanding and Predicting Changes in the Ocean Science, Technology, and Operations Workforce:

**Related Prior Studies**

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OSTO Workforce: Related Prior Studies

Overview

• Numerous prior studies of science, engineering, and technology workforces.

• But much is still unknown about the factors that affect supply of and demand for science, engineering, and technology workers (e.g., main factors, sensitivity to factors, factor relationships).

• Ability to assess and anticipate supply and demand is critical for planning and implementing ocean related activities (e.g., government, business, research activities), at all levels (e.g., national to corporate division).

• But there are relatively few prior studies with an ocean workforce focus.

• There are numerous problems with the availability of data for conducting ocean workforce studies.

• Assessments of prior studies helped set direction for OSTO project.
OSTO Workforce: Related Prior Studies
Marine Science & Engineering Industry in New England (Barrow et al. 2005)

Key Points and Comments
1. Knowledge of employers’ market important in designing and implementing economic and educational policies that affect workforce.

2. Employer-researcher-educator collaborations important in developing innovative and competitive workforces.

3. Employer cooperation in providing data is critical.

<p>| Table 5. Marine Sector Employment by State and New England Region, 2004 |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Marine Instrumentation &amp; Equipment</th>
<th>Marine Materials &amp; Supplies</th>
<th>Marine Research &amp; Education</th>
<th>Marine Services</th>
<th>Shipbuilding &amp; Design</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine</td>
<td>28</td>
<td>150</td>
<td>184</td>
<td>7</td>
<td>10,404</td>
</tr>
<tr>
<td>Connecticut</td>
<td>524</td>
<td>524</td>
<td>2</td>
<td>339</td>
<td>8,000</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>4,470</td>
<td>679</td>
<td>1,027</td>
<td>2,687</td>
<td>0</td>
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<tr>
<td>Rhode Island</td>
<td>5,179</td>
<td>278</td>
<td>119</td>
<td>1,223</td>
<td>145</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>2,295</td>
<td>464</td>
<td>126</td>
<td>53</td>
<td>0</td>
</tr>
<tr>
<td>New England</td>
<td>12,496</td>
<td>2,095</td>
<td>1,457</td>
<td>4,309</td>
<td>18,549</td>
</tr>
</tbody>
</table>

Source: D&B MarketPlace; authors’ survey.
OSTO Workforce: Related Prior Studies
Shortage of Individuals with Fisheries Science Degrees (NOAA 2008)

Key Points and Comments

1. Design and implementation of national to organizational strategic plans needs to account for workforce factors.

2. Workforce planning requires in-depth assessment of worker supply and demand --- but good data hard to find, esp. at sub-sector level.

3. Workforce projections based on assumptions and fraught with uncertainties.

4. Imbalances between worker supply and demand need to be addressed before imbalances occur, despite uncertainties.
OSTO Workforce: Related Prior Studies
Meteorology Enrollments, Degrees, and Employment (Knox 2008)

Key Points and Comments
1. Lack of data introduces many uncertainties into workforce planning.
2. Collaborative effort needed to improve workforce related data sets.
3. Educators and employers need to help students realistically prepare for careers.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All fields</td>
<td>+122%</td>
<td>+20%</td>
</tr>
<tr>
<td>Physical sciences</td>
<td>−7%</td>
<td>−2%</td>
</tr>
<tr>
<td>Geosciences</td>
<td>+83%</td>
<td>+9%</td>
</tr>
<tr>
<td>Geography</td>
<td>+74%</td>
<td>+3%</td>
</tr>
<tr>
<td>Oceanography</td>
<td>+164%</td>
<td>−31%</td>
</tr>
<tr>
<td>Meteorology</td>
<td>+161%</td>
<td>+47%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U.S. college degree recipients in</th>
<th>Class of 2006 average starting salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer science</td>
<td>$50,744</td>
</tr>
<tr>
<td>Physics</td>
<td>$45,120</td>
</tr>
<tr>
<td>Geology</td>
<td>$45,091</td>
</tr>
<tr>
<td>Mathematics</td>
<td>$44,672</td>
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<tr>
<td>Chemistry</td>
<td>$39,804</td>
</tr>
<tr>
<td>Meteorology</td>
<td>$35,211</td>
</tr>
<tr>
<td>Environmental science</td>
<td>$34,219</td>
</tr>
<tr>
<td>Secondary education</td>
<td>$33,089</td>
</tr>
<tr>
<td>History</td>
<td>$33,071</td>
</tr>
<tr>
<td>Philosophy</td>
<td>$31,774</td>
</tr>
<tr>
<td>Marine science</td>
<td>$31,643</td>
</tr>
<tr>
<td>English</td>
<td>$31,385</td>
</tr>
</tbody>
</table>
OSTO Workforce: Related Prior Studies
Engineering Talent Squeeze in Oil and Gas Production (CERA 2007)

Key Points and Comments
1. National, industry, and organizational strategic plans need to adequately account for workforce factors.
3. Employers need to prepare for projected imbalances, despite uncertainties.
OSTO Workforce: Related Prior Studies
Skills Gap in American Manufacturing Workforce (Deloitte 2005)

Key Points and Comments
1. Imbalances between required and actual skills of employees can be significant, especially as organizations and markets evolve.
2. Employer assessment of worker knowledge and skills is important feedback information for educators.
3. Employers need to share responsibility for employee training and professional development.
4. Objective and subjective data from employers is critical.
OSTO Workforce: Related Prior Studies
Bridging the Skills Gap (ASTD 2006)

Key Points and Comments
1. Knowledge and skills gaps are a natural and expected outcome of innovation, market changes, and workforce evolution.
2. Employers’ strategic plans should include plans for anticipating and correcting these gaps.
3. Employer-educator-government partnerships can help correct gaps.
OSTO Workforce: Related Prior Studies
Gathering Storm: Energizing and Employing America (NAS 2007)

Key Points and Comments

1. Development of science and technology workforce is key to competing in global market.

2. Improvements in education critical to improving quantity and quality of science technology workers.

3. Revisions to national economic and educational policies are needed to develop high performance science, engineering, and technology workforce.

![Graph showing percentage of 24-year-olds with first university degrees in the natural sciences or engineering, relative to all first university degree recipients, in 2000 or most recent year available.](image)

**FIGURE 3-16A** Percentage of 24-year-olds with first university degrees in the natural sciences or engineering, relative to all first university degree recipients, in 2000 or most recent year available.
OSTO Workforce: Related Prior Studies
Eye of the Storm: Assessing Evidence on Education, Quality, and Workforce Demand (Lowell and Salzman 2007)

Key Points and Comments
1. Data on workforce education, supply, and demand can be interpreted in very different ways --- in part due to inadequacy of data sets.
2. Low appeal of science, engineering, and technology careers needs to be considered in assessing worker supply.
3. Workforce policies and planning need to better account for global nature of workforce (e.g., education, migration, outsourcing).

Figure 4. Percent of All Degrees that are S&E Degrees Earned by Citizens and Permanent Residents

OSTO Workforce: Related Prior Studies
National Science and Engineering Indicators (NSB 2008)

Key Points and Comments

1. Intensive data collection and objective analysis is key to monitoring and understanding science and engineering workforce.

2. Long term monitoring is important for assessing worker supply-demand factors and projecting workforce evolution.

3. Data is sparse at sub-sector level (e.g., ocean workforce level).
Prior studies provide important lessons on:

a. Existing and potential workforce challenges
b. Difficulties in assessing challenges
c. Methods for identifying, analyzing, and resolving challenges
d. Importance of both quantitative data and subjective assessments
e. Motivations and methods for strategic workforce planning
f. Need for employer-employee-educator-government collaborations