Career Paths of Engineering and Computer Science Doctoral Recipients

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We appreciate the work of our full team of collaborators who contributed to this project, including Maya Denton, Dr. Jessica Deters, Dr. Gabriella Fleming, and Hannah Glisson.
Foreword

The purpose of this project is to help graduate programs think about the variety of career pathways that engineering and computer science graduate degree earners follow—and to help programs consider how they might better support graduate students who are interested in nonacademic careers in particular (i.e., government labs, industry, start-up, non-profit).

This first report from our project leverages NSF's Survey of Earned Doctorates (SED), which has collected information from research doctoral (Ph.D.) recipients from accredited institutions in the United States since 1957. The data are typically collected at the time of degree completion and generally constitute a greater than 90% response rate. We summarize national-scale data in this report for PhD earners in engineering or computer science from 2015-2019 who have known post-graduate school employment. In addition to sharing these national-scale patterns with graduate engineering leaders around the country, we also share institution-specific data for benchmarking purposes whenever sample sizes allow such data sharing.

The next project phase will interview associate deans, center directors, faculty, and alumni to understand how institutions and programs prepare Master’s and doctoral students for non-academic careers and to gain insight on how graduates make career decisions. We welcome any program that would like to share their best practices with our team—please contact a project leader if you are interested in participating (David Knight, dbknight@vt.edu; Maura Borrego, maura.borrego@utexas.edu; Dustin Grote, dustingrote@weber.edu).
Executive Summary

- **Percentage of engineering doctoral recipients by employment sector**
  - 48.3% industry; 32.8% academia; 8.4% government; 6.1% non-U.S. position; 2.9% non-profit; 1.4% (other)

- **Engineering disciplines have different career sector patterns for doctoral alumni**
  - Industry: Computer Engineering (highest, 65%) ... Environmental (lowest, 25%)
  - Academia: Bio/biomedical (52%) ... Computer Engineering (22%)
  - Government: Astro/aerospace (25%) ... Computer Science (4%)
  - Non-U.S. Position: Industrial (10%) ... Astro/aerospace (4%)
  - Non-profit: Astro/aerospace (6%) ... Materials Science and Engineering (MSE) (2%)

- **There are distinct patterns associated with demographics**
  - Compositional diversity by race (Black, Hispanic, Asian, White) differs across sectors
  - Academia is disproportionately higher for married women and women with dependents
  - Industry is disproportionately higher for unmarried men and men without dependents
  - A higher proportion of non-U.S. citizens are in industry sector jobs than U.S. citizens
  - Roughly equal proportions of U.S. citizens and non-U.S. citizens are in academia
Demographics of Respondents

Data source: Survey of Earned Doctorates, 2015-2019, PhD recipients in engineering or computer science with known employment

Gender

- Men: 78% (n = 26520)
- Women: 22% (n = 7381)

Race

- Asian: 47% (n = 15587)
- White: 44% (n = 14824)
- Hispanic: 5% (n = 1614)
- Black: 2% (n = 825)
- Other: 2% (n = 578)

First-Generation in College

- 24% FIRST-GEN (n = 7721)
- 76% NOT FIRST-GEN (n = 24294)

Citizenship

- U.S. Citizen: 91% (n = 15023)
- Non-U.S. Citizen: 10% (n = 18768)

Marital Status

- Married: 59% (n = 18002)
- Not Married: 41% (n = 14537)

Dependents

- Have Dependents: 48% (n = 7319)
- No Dependents: 52% (n = 25074)
EMPLOYMENT SECTORS ACROSS ENGINEERING AND COMPUTER SCIENCE
List of Disciplines

**Astro/Aero:** Aerospace, Aeronautical & Astronautical Engineering

**Bio/BME:** Bioengineering & Biomedical Engineering

**ChE:** Chemical Engineering

**Civil:** Civil Engineering

**CompE:** Computer Engineering

**CS:** Computer Science

**Electrical:** Electrical, Electronics, & Communications Engineering

**Env:** Environmental/Environmental Health Engineering

**IE:** Industrial & Manufacturing Engineering

**MSE:** Materials Science Engineering

**ME:** Mechanical Engineering
Percentage of Engineering/CS Doctoral Recipients in Each Employment Sector

Of doctoral recipients with employment, here's where they ended up right after graduate school:

<table>
<thead>
<tr>
<th>Employment Sector</th>
<th>Percentage of Engineering/CS Doctoral Recipients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>48.3</td>
</tr>
<tr>
<td>Academia</td>
<td>32.8</td>
</tr>
<tr>
<td>Government</td>
<td>8.4</td>
</tr>
<tr>
<td>Non-U.S. position</td>
<td>8.4</td>
</tr>
<tr>
<td>Non-profit</td>
<td>6.1</td>
</tr>
<tr>
<td>Other</td>
<td>2.9</td>
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<tr>
<td></td>
<td>1.4</td>
</tr>
</tbody>
</table>
Employment Sector by Discipline

Of doctoral recipients with employment, here's where they ended up right after graduate school.
INDUSTRY

48% of all engineering/CS PhDs are working in INDUSTRY
*employment right after grad school

WHERE THEY'RE FROM
(by % of grads in INDUSTRY)

Top 3
- CompE: 65% of CompE PhDs are in industry
- Electrical: 62% of Electrical PhDs are in industry
- CS: 56% of CS PhDs are in industry

Bottom 3
- Civil: 36% of Civil PhDs are in industry
- Bio/BME: 33% of Bio/BME PhDs are in industry
- Env: 25% of Env PhDs are in industry

WHO THEY ARE (demographics of PhD grads in INDUSTRY)

- 54% are Asian
- 39% are White
- 4% are Hispanic
- 2% are Black
- 1% Other

- 80% are MEN
- 20% are WOMEN

22% are FIRST-GEN
40% are U.S. CITIZENS
19% have KIDS
33% of all Engineering/CS PhDs are working in academia

*employment right after grad school

Who they are (demographics of PhD grads in Academia)

- 44% are Asian
- 46% are White
- 5% are Hispanic
- 3% are Black
- 2% Other

76% are men
24% are women

23% are first-generation
44% are U.S. citizens
20% have kids

Where they're from (by % of grads in Academia)

Top 3
- Bio/BME: 52% of Bio/BME PhDs are in academia
- Env: 47% of Env PhDs are in academia
- Civil: 41% of Civil PhDs are in academia

Bottom 3
- Astro/Aero: 29% of Civil PhDs are in academia
- Electrical: 23% of Electrical PhDs are in academia
- CompE: 22% of CompE PhDs are in academia
8% of all engineering/CS PhDs are working in GOVERNMENT
*employment right after grad school

WHERE THEY'RE FROM (by % of grads in GOVERNMENT)

Top 3

- Astro/Aero: 25% of Astro/Aero PhDs are in government
- MSE: 12% of MSE PhDs are in government
- Env: 12% of Env PhDs are in government

Bottom 3

- Bio/BME: 4.3% of Bio/BME PhDs are in government
- CompE: 4.2% of CompE PhDs are in government
- CS: 3.8% of CS PhDs are in government

WHO THEY ARE (demographics of PhD grads in GOVERNMENT)

- 22% are Asian
- 65% are White
- 6% are Hispanic
- 4% are Black
- 3% Other

- 79% are MEN
- 21% are WOMEN

- 20% are FIRST-GEN
- 81% are U.S. CITIZENS
- 27% have KIDS
6% of all U.S. engineering/CS PhDs are working in NON-U.S. POSITIONS (employment right after grad school).

**WHO THEY ARE**
- 45% are Asian
- 43% are White
- 9% are Hispanic
- 1% are Black
- 2% Other
- 78% are men
- 22% are women
- 31% are first-gen
- 17% are U.S. citizens
- 39% have kids

**WHERE THEY'RE FROM**
(by % of grads in NON-U.S. POSITIONS)
- IE: 10% of IE PhDs are in non-US roles
- Env: 10% of Env PhDs are in non-US roles
- Civil: 9.9% of Civil PhDs are in non-US roles
- MSE: 4% of MSE PhDs are in non-US roles
- Bio/BME: 4.2% of Bio/BME PhDs are in non-US roles
- Astro/Aero: 4.3% of Astro/Aero PhDs are in non-US roles
NON-PROFIT

3% of all engineering/cs PhDs are working in NON-PROFIT
*employment right after grad school

WHERE THEY'RE FROM
(by % of grads in NON-PROFIT)

Top 3
- Astro/Aero: 5.5%
- IE: 4.8%
- Env: 3.9%

Bottom 3
- ChE: 2.2%
- Civil: 1.9%
- MSE: 1.9%

WHO THEY ARE (demographics of PhD grads in NON-PROFIT)
- 38% are Asian
- 53% are White
- 3% are Hispanic
- 4% are Black
- 2% Other
- 74% are MEN
- 26% are WOMEN
- 19% are FIRST-GEN
- 57% are U.S. CITIZENS
- 24% have KIDS
EMPLOYMENT SECTORS ACROSS DEMOGRAPHIC GROUPS
Employment Sector By Race

Percent of PhD recipients of the specified race who are employed in each specified sector following graduate school. For example, 56% of ASIAN graduates are in industry; 34% of WHITE graduates are in academia.

ASIAN:
- Industry (56%)
- Academia (31%)
- Government (4%)
- Non-U.S. position (6%)
- Non-profit (2%)
- Other (1%)

WHITE:
- Industry (42%)
- Academia (34%)
- Government (12%)
- Non-U.S. position (6%)
- Non-profit (3%)
- Other (2%)

HISPANIC:
- Industry (38%)
- Academia (37%)
- Government (10%)
- Non-U.S. position (11%)
- Non-profit (2%)
- Other (2%)

BLACK:
- Industry (22%)
- Academia (33%)
- Government (14%)
- Non-U.S. position (3%)
- Non-profit (4%)
- Other (2%)
Employment Sector by Race

Of the engineering PhD recipients in each sector, here's the breakdown by race:

**Industry**
- Asian (54%)
- White (39%)
- Hispanic (4%)
- Black (2%)
- Other (1%)

**Academia**
- Asian (44%)
- White (46%)
- Hispanic (5%)
- Black (3%)
- Other (2%)

**Government**
- Asian (22%)
- White (65%)
- Hispanic (6%)
- Black (4%)
- Other (3%)

**Non-U.S.**
- Asian (45%)
- White (43%)
- Hispanic (9%)
- Black (1%)
- Other (2%)

**Non-Profit**
- Asian (38%)
- White (53%)
- Hispanic (3%)
- Black (3%)
- Other (2%)

Note: "Other" includes American Indian or Alaska Native; Native Hawaiian or other Pacific Islander; Multiple racial responses that cannot be prioritized into another category.
Sector by Gender and Marital Status of Engineering/CS PhDs

Overall Trends - Marital Status

- Gender/marital status composition is reversed for the industry sector and academia.
- A higher proportion of men, overall, entered the industry sector.
  - Unmarried men entered industry at a slightly higher rate than married men.
  - Married and unmarried men both entered industry at a higher rate than married and unmarried women.
- A higher proportion of women are in academia.
  - Married women entered academia at a higher rate than unmarried women.
  - Married and unmarried women both entered academia at a higher rate than married and unmarried men.
Sector by Gender and Dependents of Engineering/CS PhDs

Overall Trends - Gender & Dependents

- Employment sector trends based on gender and dependents are similar to gender/marital status trends: Gender/dependents trends are reversed for the industry sector and academia.

- Men without dependents entered the industry sector at the highest rate (51%)
  - Women with dependents entered the industry sector at the lowest rate (36%)

- Women with dependents entered academia at the highest rate (38%)
  - Men with dependents entered academia at the lowest rate (29%)
Employment Sector by Dependents

Overall Trends - Dependents

- There are higher proportions of graduates without dependents in industry and academia
  - 50% of grads without dependents are in industry versus only 43% of grads with dependents
  - 34% of grads without dependents are in academia (vs 30% with of grads with dependents)

- Graduates with dependents are found in government, non-U.S. positions, and non-profit roles at higher percentages than graduates without dependents
Sector by Citizenship of Engineering/CS PhDs

Overall Trends - Citizenship

- A higher proportion of non-U.S. citizen PhDs are in **industry** sector jobs (52%) than U.S. citizens (44%)

- Roughly equal proportions of U.S. citizen (33%) and non-U.S. citizen (33%) PhDs are in **academia**

- A higher proportion of PhDs who are U.S. citizens are in **government** sector jobs (15%) than PhDs who are not U.S. citizens (3%)

- Non-citizen PhDs entered **non-U.S. positions** at a higher rate (9%) than U.S. citizen PhDs (2%)
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