Paths to the engineering deanship seem fairly straightforward but work is needed to enhance their access to women and underrepresented minorities.

Paths to the Deanship in American Academic Engineering:
A Snapshot of Who, Where, and How

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This article presents findings from analysis of information on 186 full-time and interim/acting deans of engineering in the United States. The information consists of the deans' gender and race/ethnicity as well as their educational background and career trajectory—the universities from which they earned their doctorate,[1] previous administrative posts, and whether they assumed the deanship at their current institution or by relocating to another or from outside academia.

Background

The impetus for this study emerged from a June 2017 meeting of African American women engineering faculty celebrating the election of the first African American woman as president of the American Society for Engineering Education (ASEE). The celebration was tempered somewhat by the recognition that professional advancement for women in general and African American women in particular has been slow in academic engineering, notwithstanding the good faith efforts of individuals and organizations to improve that condition.

The African American women who came together were representatives of a very small group: 255 tenured full professors in a population of nearly

[1] All but one of the 186 deans have a doctorate. The other has an MBA.

27,000 tenured and tenure-track engineering faculty members (Yoder 2016). Their success may be instructive to efforts to increase diversity in engineering. Some are products of K–12 schools that remained characterized by racial segregation and unequal funding and resources well after *Brown v. Board of Education, Topeka*. More often than not, most of them were the only woman of color (or one of very few) in engineering programs, both as students and as professors. Their achievements in earning tenure and the rank of full professor, and the election of an African American woman as ASEE president, are all the more impressive in light of the barriers that had to be overcome.

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As intended, the meeting was given over to asking basic questions of both the honoree and the other women present: How did you succeed? What were the toughest barriers to your success? Who or what made that possible? To what do you aspire in academic engineering? If a deanship, why? Is there a single path that leads to a deanship, or might an ambitious engineer forge a different route?

The conversation was rich and ended with commitments to work together to advance African American women entering, remaining, and succeeding in academic engineering. One way to achieve those ends is to try to understand the path by which a person can aspire to and pursue advancement in academic engineering.[2] This analysis describes that path and the people who successfully navigated it.

[2] Interest in understanding was further piqued by the results of another study examining the leadership of research-intensive universities (Skinner 2018a). It showed a significant increase in the number of engineering deans who were named university presidents and provosts. Several African American women engineering faculty at the June 2017 gathering expressed their long-term interest in pursuing such posts.

Selection of Deans Studied

With this background, the choice of deans to consider in mapping a path to the deanship tilted toward engineering programs in which efforts were already under way to diversify both student populations and faculties. Sorting through and establishing the equivalence or effectiveness of each diversity-oriented activity or initiative at an engineering school or college proved impossible.

Fortunately, ASEE launched in 2014–15 the "Year of Action in Diversity," calling on engineering deans to commit themselves and their institutions to specific actions "to provide increased opportunity to pursue meaningful engineering careers to women and other underrepresented demographic groups" (ASEE 2018). The 186 signatories as of November 2017 are the subjects of this analysis, based on information about them available from their university's website.

Demographics

Gender, race/ethnicity, and place of origin remain powerful descriptors of persons who hold leadership positions in any of the professions in America, and academic engineering is no different. Each trait usually "stands for" a set of experiences and historical and cultural influences distinctive to the persons with those characteristics. The time may come when these aspects will cease to substitute for an understanding of an individual's unique experiences and attributes; that time has not come yet.

Gender and Race/Ethnicity

Overall, women remain underrepresented in leadership positions (Warner and Corley 2017). Yet more women than men enter and graduate from college. They earn nearly half of all law degrees, medical degrees, and MBAs, and account for 47 percent of the labor force and 59 percent of the college-educated, entry-level workforce. But leadership positions in virtually all professions remain disproportionately male, including the 70 percent of college and university presidents (ACE 2017).

Academic and professional engineering remains very much the province of white men and, as such, resembles much of the rest of higher education leadership. Women make up less than one fifth (18 percent) and underrepresented minorities account for 10 percent of the sample of deans analyzed here (table 1).

These figures stand out more clearly in comparison with analogous positions in academia and the population at large. Approximately one third of all deans in

the arts and sciences are women (Behr and Schneider 2015), and among deans of teacher education women constitute just over half (AACTE 2018). But although women's representation among deans of engineering is almost exactly the same as their proportion of deans of medicine (17 percent; Skinner 2018b, table 1), the number and percentages of women joining academic medical faculties have increased substantially in a relatively short time—from 29 percent in 2001 (Jolliff et al. 2012) to 39 percent in 2015 (AAMC 2016, table 3)—whereas the representation of women on engineering faculty rose just 4 percent from 2006 to 2014, to only 16 percent of all professors (Yoder 2016).

Engineering also shares with its sibling professions a challenge in increasing the racial diversity of its student and faculty populations. African Americans constitute a scant 2.3 percent and Hispanics 3.7 percent of all engineering faculty, percentages that remain stubbornly unchanged since 2007 (Yoder 2016). Moreover, were it not for the engineering programs offered at historically black colleges and universities (HBCUs), Puerto Rican institutions, and Hispanic-serving universities, the representation from populations other than white persons would be smaller still.

Clearly, the representation of 14 African Americans (7 percent) among engineering deans is an accomplishment for those men and women, save for the fact that only two are women.

Foreign Birth/Foreign Education

As resourceful as engineers are, they do not control their place of origin, so where they come from can be considered a demographic attribute rather than a choice.

The number of foreign-born or foreign-educated deans of engineering—54, or just under a third of the sample—reflects a variety of factors, including changes to immigration policy in 1965 that encouraged the relocation of Indians and South Koreans (Skinner 2013) and later Iranians and placed a premium on reunifying families. The latter enabled numerous students studying engineering in American programs to seek US citizenship, complete their studies, and join engineering faculties, then assist siblings to join them in America.

Other factors encouraging foreigners to immigrate to the United States were the rapid growth of demand for engineers in the US space program, increased world appetites for oil and other extractive resources, more intense global competition for manufactured goods, an increase in large-scale construction and civil projects, the emergence of information technologies, and political upheavals in countries such as Iran with educated populations. In most cases, women were not part of the labor demand in these areas and thus did not benefit from them. Only 8 of the 54 foreign-born/-educated deans are women.

TABLE 1 Demographics of 186 US deans/ interim deans of engineering

Gender	Percent	Number
Female	18%	33
Male	82%	153
Race/ethnicity		
African American	7%	14
Asian American	16%	29
Caribbean	0.5%	1
Latino/Hispanic/Chicano	2%	4
White	74%	137
Unable to determine	0.5%	1
Foreign-born/-educated		
Yes	29%	54
No	65%	121
Unable to determine	6%	11

To reiterate, then: American academic engineering leadership remains a male domain, only slightly less white than was the case in the past, and having benefitted from the immigration of talented, mostly male engineers.

Education and Professional Experience

The institution from which a dean earned a doctorate is not a unilateral decision on the part of the individual, but does reflect aspiration, application, and some element of luck. The engineering deans and interim deans in this sample have doctoral degrees from 83 universities, with some concentration in degrees from 21 institutions, which account for 46 (about one quarter) of the deans (table 2). Those 21 universities have familiar names, but they are not the only pathways by which to become a dean.

Previous employment experience outside higher education is also considered. This is somewhat problematic to determine since academic engineering entails

TABLE 2 Where US engineering deans and interim deans earn their doctorates

Number of deans/interim deans	University
13	MIT
8 each	Berkeley, Stanford
7	Michigan
6	Caltech
5 each	Georgia Tech, NC State, Penn State, Rice, Virginia Tech
4 each	Carnegie Mellon, Minnesota, Ohio State
3 each	Cambridge, Cincinnati, Cornell, CU Boulder, Notre Dame, Purdue, Texas Tech, UT Austin
2 each	17 universities
1 each	45 universities
3	Unable to determine
1	MBA rather than doctorate

frequent and often in-depth engagement with sectors beyond the campus. For this analysis, nonacademic professional experience is defined as full-time employment by entities other than colleges, universities, engineering associations, and/or professional societies. (A rotating assignment at the National Science Foundation [NSF] is considered outside employment.)

As with any professional program, engineering deans engage with nonacademic organizations and persons, including practicing engineers. And as is also the case in other professional fields, the importance of having worked full-time outside academia varies. Nevertheless, an effort was made to determine whether the 186 deans had been employed (other than as consultants) in industry, government, or not-for-profit organizations. Among the 186 deans in this sample, more than half—107 (57 percent)—have experience outside academia.

Given recent discussions in the academic engineering community about the relevance and "real world" applicability of curricula, pedagogy, and learning formats as well as the workplace readiness of engineering graduates, a stint as a practicing engineer outside academia may add to advancement prospects as an academic engineer.

Career Progression to the Deanship

The data suggest that the pathway to an engineering deanship generally adheres to a conventional route involving both support from one's immediate colleagues and experience with resource management, curriculum, students, academic personnel, and, increasingly, fundraising.

Tenure and the rank of full professor are almost universally considered minimal requirements for a deanship. Beyond that, service as a department chair or head is far and away the post from which one moves on to an engineering deanship (table 3), either immediately prior (39 percent) or one step before being appointed to the position (20 percent). In addition to handling duties and responsibilities comparable to those of a dean, a department chair typically has to have collegial ties and respect in a peer-driven environment. Summing across the first row of table 3 reveals that 110 (59 percent) of the 186 deans and interim deans chaired a department at some point before becoming dean.

Next in frequency of positions is that of associate or assistant dean, followed closely by interim dean. Depending on the size and complexity of the university's engineering program, the scope of responsibility in associate/assistant deanships can involve everything from oversight of student internships, co-op arrangements, and international experiences to the equivalent of a chief operating officer of the college or school and thus experience in most, if not all, of the functions of a dean.

The post of interim/acting dean ranks third in frequency as the position immediately prior to becoming dean in fact, whether at one's current or another university.

Relocation and Rankings

Analysis of the data from this sample reveals that "outsiders" make up nearly two thirds (63 percent) of current deans, suggesting that those who aspire to the position

TABLE 3 Progression to engineering deanship/interim deanship (sample of 186 deans)

Rank by frequency	Position immediately prior to deanship	Position 2 steps prior to deanship
1st	Department chair or head 72 (39%)	Department chair or head 38 (20%)
2nd	Associate or assistant dean 24 (13%)	Director[a] 20 (11%)
3rd	Interim dean 23 (12%)	Associate or assistant dean 19 (10%)
4th	Dean 19 (10%)	Interim chair 5 (3%)
5th	Director[a] 18 (10%)	Associate provost, vice president 4 (2%)
	Engineering/nonengineering faculty[b] 30 (16%)	Not applicable 100 (54%)

[a] The title "director" here involves administration of a project or laboratory of considerable scale and does not designate the head of an academic unit.
[b] Some of the engineering programs are housed with academic disciplines other than physics or materials science, one or both of which are sometimes housed with engineering.

TABLE 4 Relocation by engineering deans among institutions by ranking (based on *US News & World Report*)

New institution is…	Number (Percent)
a peer	48 (41%)
lower ranking	52 (44%)
higher ranking	14 (12%)
…or former institution is not a university[a]	4 (3%)

[a] These include colleges and nonacademic entities such as government agencies and businesses.

may well be required to forsake professional and personal ties to a university in order to gain an engineering deanship.

Separation may be eased somewhat by the standing of an incoming dean's new institution—if it is a peer or of a higher rank than the one left. Rankings that use both quantitative indicators and provosts' or presidents' perceptions of universities or programs other than their own are abundant.[3] To determine whether a dean moved to a university of greater, less, or the same prestige as that of the current institution, relocations were reviewed and categorized using both the institutional and the engineering program rankings of *US News & World Report* (based on quartiles of both rankings) (table 4).

[3] An incomplete list of college rankings includes those of *US News & World Report*, *Princeton Review*, *Wall Street Journal/Times Higher Education*, *The Economist*, *Forbes*, *Fiske Guide*, and *Kiplinger Business*.

Moves to peer institutions or to universities with lower ranking than that of the deans' former institution are the prevailing patterns of such relocations. Much less frequently does an individual move to a deanship at a university that ranks higher than the current or former institution.

Additional Factors

Most engineering deans are cited for their excellence as a teacher. They publish in peer-reviewed journals of national and international prominence and compete successfully for external funding to support research as well as a retinue of postdoctorates, doctoral and master's students, and undergraduates.

Service—be it to one's department, the college of engineering, the university, academic and professional associations, licensing agencies, government and intergovernmental organizations—is expected, though its relative weight vis-à-vis research and publications,

grantsmanship, and teaching varies among institutions and even departments in the same college of engineering.

Unlike their brethren in academic medicine (and, as noted above, deans of engineering and medicine are predominantly male), the necessary formal education and training in engineering at the undergraduate and graduate levels can be shorter, so professional growth and advancement can begin earlier such that a precocious academic engineer may be named a dean relatively early in her career.

Concluding Thoughts

The path to becoming a dean of engineering is straightforward enough: aligned to the conventions of universities but respectful of time spent beyond the cloisters in the practice of engineering. Preparation for seeking a deanship almost always entails successful service as a department chair or an associate or assistant dean. Directing large-scale projects of special significance can sometimes substitute for experience as a chair or associate dean, but the project must demonstrate skills commensurate with those of the more conventional stages along the path to a deanship.

Attending the "right school"—especially the right doctoral-granting university—strengthens one's candidacy for a deanship in engineering, but the circle of elite institutions from which to begin one's career is neither especially small nor fixed in its membership. And being dean at one of the higher-ranked schools affords more opportunities, including the chance to be provost or president of a high-ranking university (Skinner 2018a).

This brief portrait of pathways to engineering deanships does not do justice to the challenges, expectations, and complexities of the position or, for that matter, to the extraordinary success and international acclaim for American engineering, both within the academy and beyond. It may, however, suggest areas for improvement to expand access and enhance representation so that the people in these important positions better reflect the vibrant diversity of their students and the population. For example, research is needed to identify where along the pipeline of students—beginning in K–12—the numbers of currently underrepresented populations in engineering can be increased significantly and sustainably. Research may also consider what role deans should play in encouraging faculty members to explore administrative posts that may position them on the path to higher appointments.

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