Analysis of the state of tenure-line black engineering faculty in research-intensive (R1) institutions

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Work in Progress: Analysis of the state of tenure-line black engineering faculty in research-intensive (R1) institutions

Introduction and Rationale for the Study

The American Society for Engineering Education (ASEE) dubbed the 2014-2015 academic year as the Year of Action in Diversity. Supporting this significant event and recognizing the urgent need of increasing diversity, deans of engineering schools across the United States signed pledges to act on four major diversity initiatives. One of these initiatives addresses the commitment of developing and implementing proactive strategies for increasing the representation of women and underrepresented minorities within the engineering professoriate [1]. One general measure of success outlined in the pledge is a "notable increase" in diversity in engineering faculty over the next decade.

This work-in-progress paper presents preliminary findings from a cross-sectional study of data obtained from the 5-year post-pledge period (2014-2018) focusing on the state of black tenure-line engineering faculty in research-intensive (R1) universities. The main objective of this study is to determine if the engineering professoriate is on a path to see a "notable increase" in the number of black tenure-line engineering faculty, which is needed to notably increase the overall diversity.

The 2018 Carnegie Classifications of Institutions of Higher Education divides universities into three categories: Very-High Research, High Research, and Doctoral/Professional [2]. The focus of this paper is on the Very-High Research activity institutions (traditionally called R1). There are 131 R1 universities located in 43 States and Washington, D.C. Seven States currently do not have R1 universities including Alaska, Idaho, Maine, North Dakota, South Dakota, Vermont, and Wyoming. Of the 131 R1 universities, about 121 universities offer engineering degrees.

Faculty demographics information for 113 of the 121 R1 engineering schools were obtained from the American Society for Engineering Education's (ASEE) College Profiles Data [3]. The percentage of faculty who provided demographics data in those 113 R1 schools varies 91-93% between 2014 and 2018. Therefore, the data is sufficiently large enough to draw some conclusions about all R1 schools (only eight R1 schools with engineering programs did not disclose a breakdown of faculty demographics on the latest 2018 ASEE data).

The number of engineering deans signing the ASEE diversity pledge from those 113 R1 institutions has reached 85 at time of writing of this paper. Given there is such an interest in diversifying the engineering professoriate, a logical question is what is the status of the tenure-line black engineering faculty 5-years after the pledge? Findings are reported by incorporating multi-level factors, including but not limited to gender, rank, geographical location, and private/public status of the institutions. Note that tenure-line in this paper refers to both tenure-track and tenured faculty. This work-in-progress does not include non-tenure track faculty because the ASEE Profiles database does not provide faculty demographics for non-tenure track faculty.

Preliminary Data Analysis

Total vs. black tenure-line engineering faculty numbers:
Figure 1 shows the total number of tenure-line engineering faculty of all races in the 113 R1 institutions in the 5-year post-pledge years. The data indicates that there was a noticeable presence of hiring opportunities for engineering faculty in R1 institutions. The total number increased from 17,107 in 2014 to 18,843 in 2018 for a gain of 1,736 faculty from all races in the 113 R1 institutions.

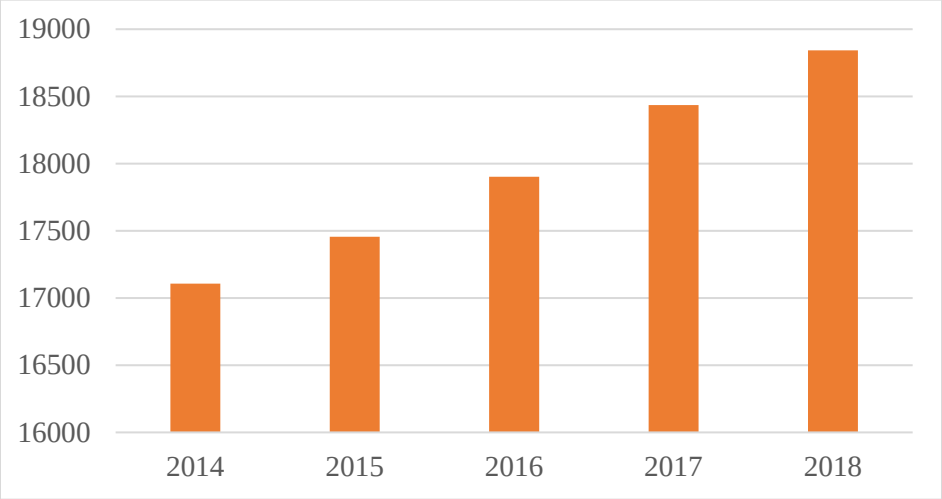

Fig.1. Total number of tenure-line engineering faculty in the 113 R1 institutions studied

Figure 2 shows the number of black tenure-line engineering faculty in those 113 R1 institutions. The trend is slightly up from 354 in 2014 to 418 in 2018 for a gain of only 64 faculty over the 5-year period. However, the overall proportion of black tenure-line faculty in the engineering professoriate can be described as stagnant ranging from 2.06% to 2.22% as shown in Figure 3.

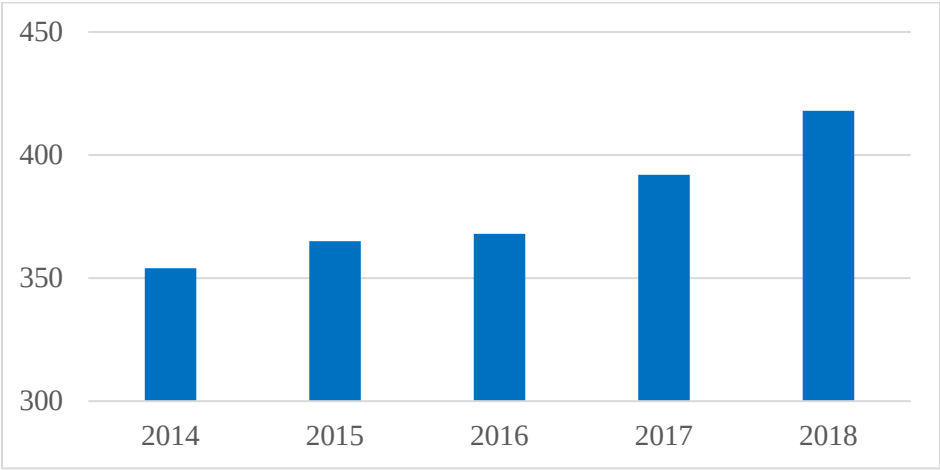

Fig.2. Number of black tenure-line engineering faculty in the 113 R1 institutions studied

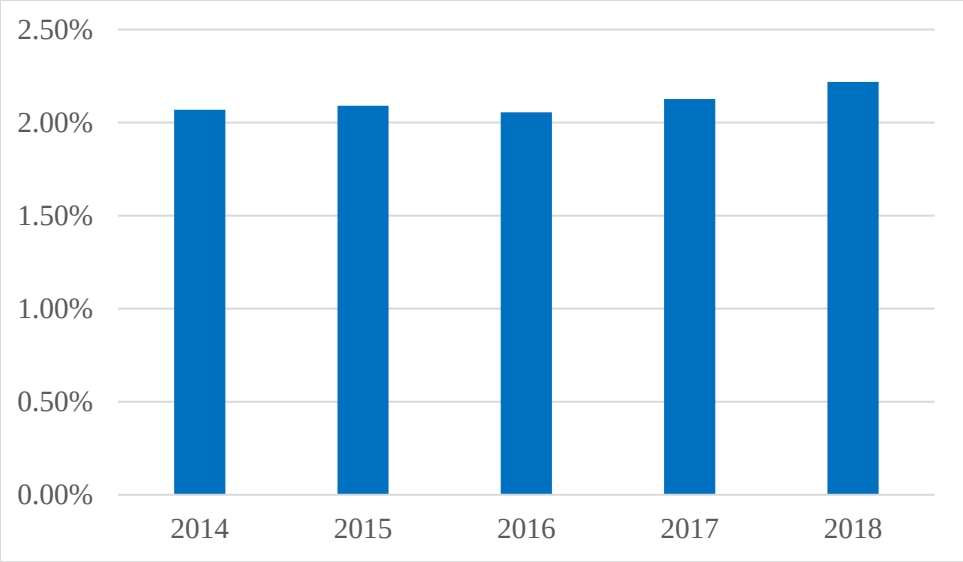

Fig.3. Percentage of black tenure-line engineering faculty in the 113 R1 institutions studied

Black tenure-line engineering faculty numbers by gender and rank:
Figure 4 shows the number of black male tenure-line engineering faculty in the 113 R1 institutions. The number of black male tenure-line faculty across all ranks increased from 274 in 2014 to 310 in 2018, an increase of 36 faculty in 5 years. The breakdown by rank is as follows: the number of male full professors increased from 118 in 2014 to 130 in 2018; the number of male associate professors increased from 89 in 2014 to 96 in 2018; and the number of male assistant professors increased from 67 in 2014 to 84 in 2018.

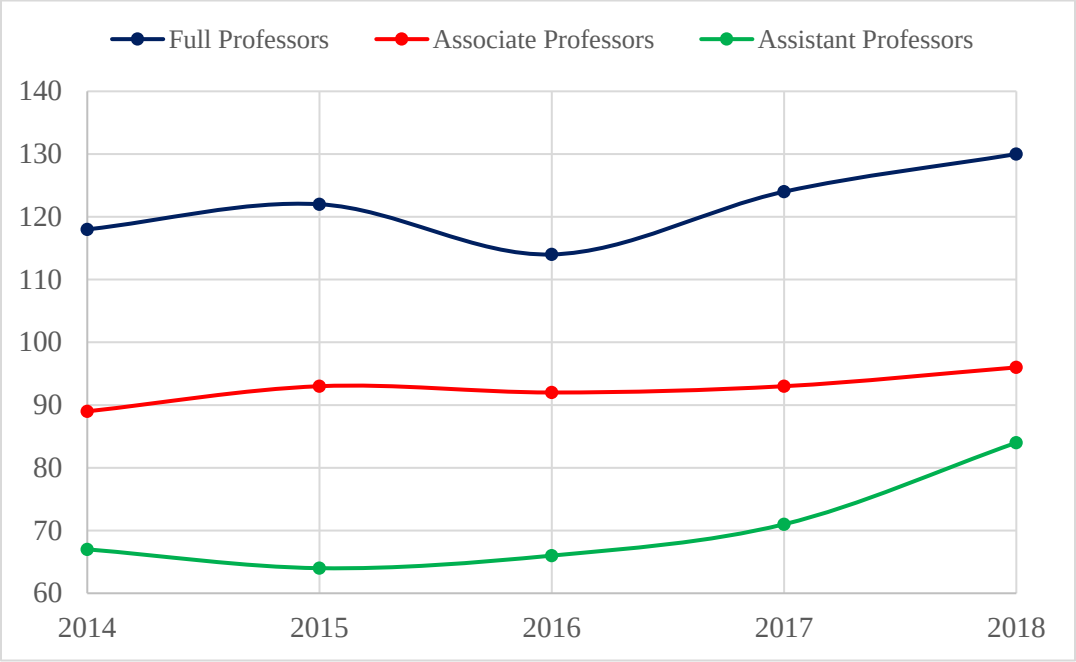

Fig.4. Number of black male tenure-line engineering faculty in the 113 R1 institutions studied

Figure 5 shows the number of black female tenure-line engineering faculty in those 113 R1 institutions. The number of black female tenure-line faculty across all ranks increased from 80 in 2014 to 108 in 2018, an increase of 28 faculty in 5 years. The breakdown by rank is as follows: the number of female full professors increased from 15 in 2014 to 24 in 2018; the number of female associate professors increased from 34 in 2014 to 36 in 2018; and the number of female assistant professors increased from 31 in 2014 to 48 in 2018.

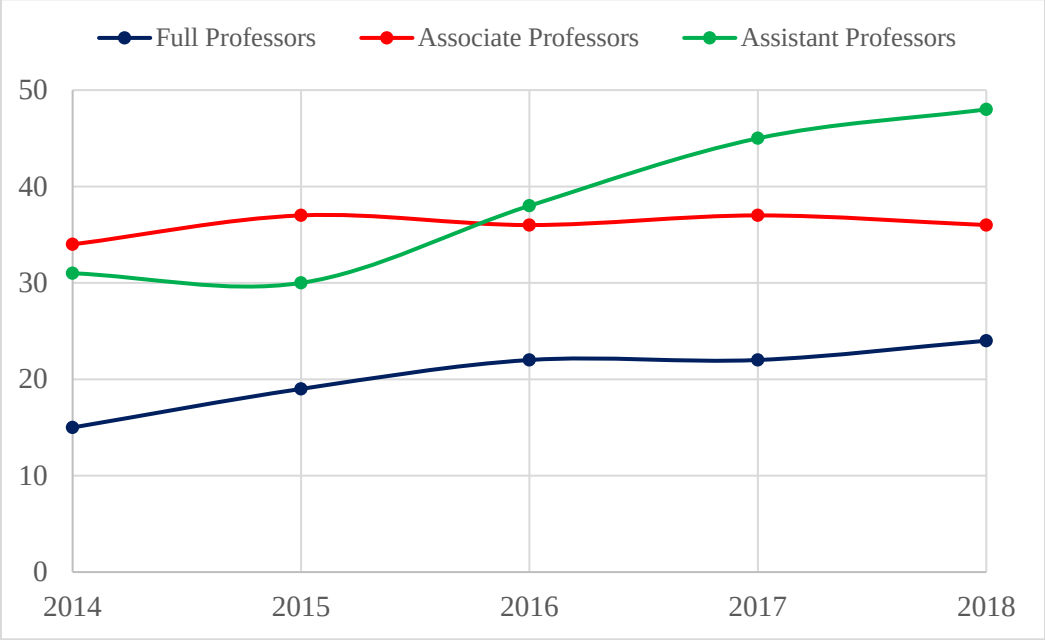

Fig.5. Number of black female tenure-line engineering faculty in the 113 R1 institutions studied

In terms of rank, of the 64 net increase in black-tenure line faculty in the last 5 years, the assistant professor rank saw an increase by more than half (34). If sustained, this is positive news. The ratio of female to male black tenure-line engineering faculty is consistently 23-26% in those 5 years. This number mirrors the percentage of doctoral degrees awarded to all women (regardless of race) in engineering from all R1/R2/R3 institutions.

Black tenure-line engineering faculty numbers by geographical distribution:
Using the 2018 ASEE Profiles data, Table 1 shows the top ten States with the highest number of black tenure-line engineering faculty in those 113 R1 institutions. Approximately two-thirds of the black tenure-line engineering faculty work in these ten States. It is no surprise that States such as Florida, Texas, California and New York rank higher in terms of the number of black tenure-line engineering faculty given they are in the top 5 States with the highest overall black population.

Table 1 – Top ten States by black tenure-line engineering faculty size (total of 113 R1 schools = 418 in 2018)

Rank	State	# of black tenure-line engineering faculty
1	Florida	49
2	Texas	33
3	California	29
4	Massachusetts	28
5	New York	24
6	Michigan	23
7	Georgia	22
8	Illinois	20
9	Pennsylvania	19
10	Maryland	18

On average, there are only 3.7 black tenure-line engineering faculty members in the 113 R1 institutions. Table 2 shows the top ten States using the average normalized ratio. For example, California has a total of only 29 black tenure-line faculty in its 11 R1 engineering schools. While it is ranked third in Table 1, it will be ranked lower in Table 2 (ranked #26). The data also shows that the distribution within a given State is not necessarily uniform. For example, 3 of the 11 California R1 engineering schools do not have any black tenure-line engineering faculty.

Table 2 – Top ten States by baseline ratio (average of all 113 R1 schools = 3.7 in 2018)

Rank	State	# of 2018 black tenure-line engineering faculty normalized by # of R1 engineering schools in the State
1	Georgia	11.0
2	Maryland	9.0
3	Florida	8.2
4	Michigan	7.7
5	Delaware	7.0
6	Illinois	6.7
7	North Carolina	5.5
8	Indiana	5.0
9 (tie)	Massachusetts	4.67
9 (tie)	Alabama	4.67

Black tenure-line engineering faculty numbers by private vs. public R1 institutions:
Of the 113 R1 institutions covered here, 83 are public (73.5%) and 30 are private not-for-profit (26.5%). Figure 6 shows the number of black tenure-line engineering faculty by public vs.

private R1 status in 2014 and in 2018. The trend is slightly up for both categories of institutions with increases of 44 and 20 in public and private institutions respectively over the 5-year period.

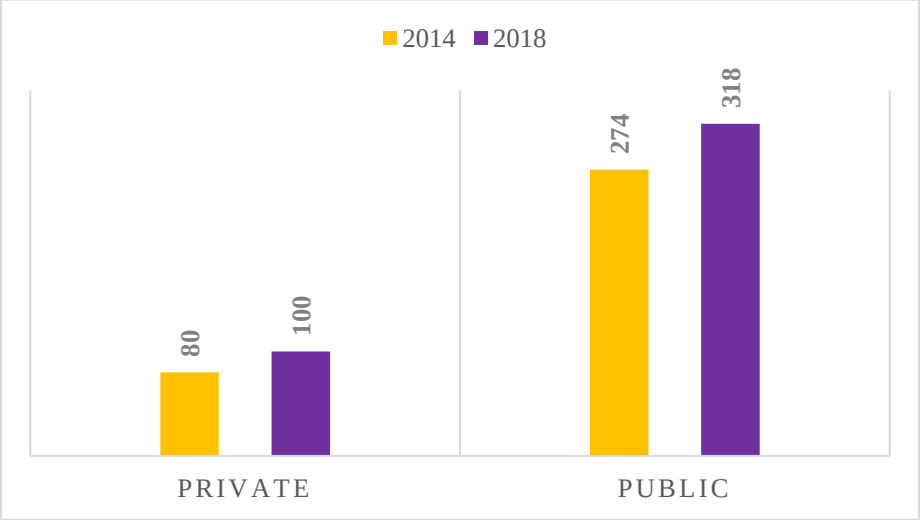

Fig.6. Number of black tenure-line engineering faculty by public vs. private status in the 113 R1 schools studied

Black tenure-line engineering faculty numbers by AAU R1 vs. non-AAU R1 institutions:
Of the 113 R1 institutions studied, 55 are members of the selective Association of American Universities (AAU) consisting of leading research universities (23 private and 32 public). Figure 7 shows the number of black tenure-line engineering faculty in AAU R1 vs. non-AAU R1 institutions in 2014 and in 2018. The trend here is also slightly up with increases of 42 and 22 in AAU R1 and non-AAU R1 institutions respectively over the 5-year period. Prestige and possibly more financial resources in AAU R1 engineering schools may have contributed to the larger increase when compared to non-AAU R1 engineering programs.

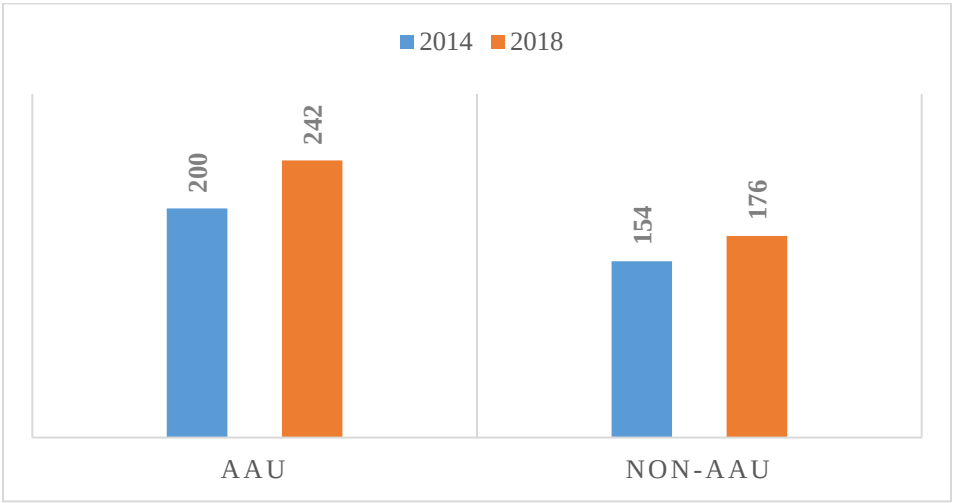

Fig.7. Number of black tenure-line engineering faculty by AAU vs. non-AAU status in the 113 R1 schools studied

Discussion

The preliminary data analysis shows that hiring trends are slightly up for black tenure-line engineering faculty. However, the proportional rate of increase is persistently stagnant. If the net increase of black tenure-line engineering faculty in 113 R1 schools is only 64 in the 5-year period, engineering deans' pledge of "notable increase" in the next decade may not be achievable in the black engineering faculty category in R1 schools. It is reasonable to conclude that the small increase is particularly disappointing given all the discussion and emphasis surrounding diversity in higher education in recent years.

Why is this net increase low? Certainly, this question will not have a unique answer. It is the author's experience that discussions surrounding this issue quickly turn into the so-called "pipeline problem"- the belief that there are not enough black engineering students earning PhD degrees. To put the "pipeline problem" narrative to test, the number of black students who received PhD degrees in engineering from the same 113 R1 institutions is examined for the 5-year period. The result is shown in Figure 8. There were 722 black engineering PhD graduates from 2014-2018 alone (ponder what the number would be if the analysis was expanded to include years prior to 2014).

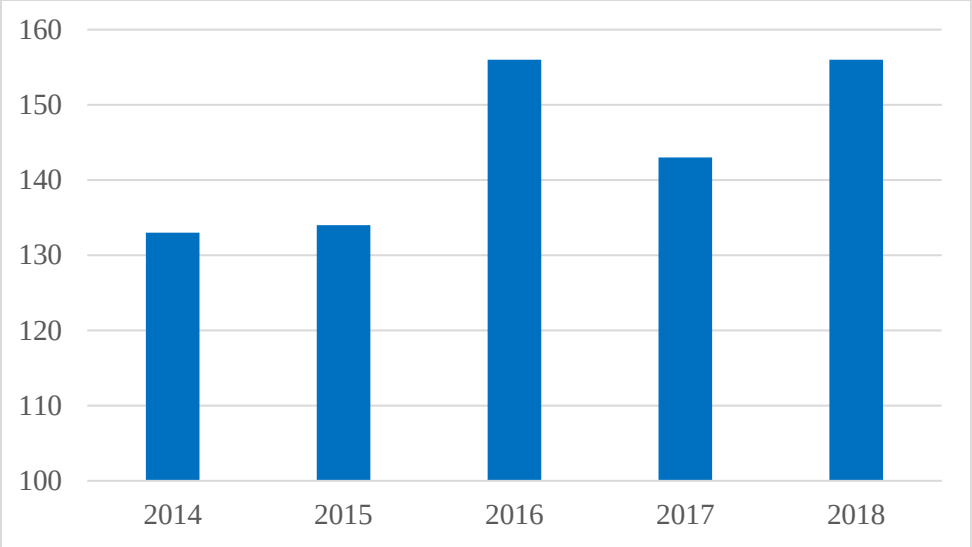

Fig.8. Number of black engineering students earning PhD degrees from 113 R1 schools studied

Note that Figure 8 does not include black engineering students who have received their PhD degrees from R2 and R3 institutions. For the sake of a broader picture, Figure 9 shows the total number of PhD degrees earned by black students in engineering disciplines from all R1/R2/R3 institutions in the 5-year period. There were 1,005 black engineering PhD graduates in 2014-2018 alone.

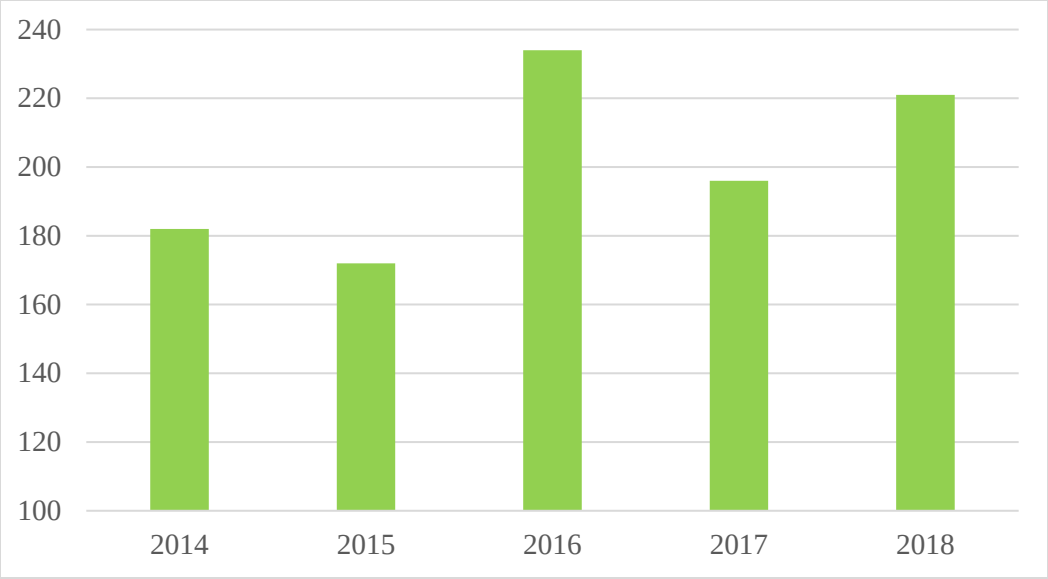

Fig.9. Number of black engineering students earning PhD degrees from all schools (R1/R2/R3)

It is clear that the "pipeline problem" narrative is glaringly insufficient to explain the lack of black tenure-line engineering faculty if the net increase in the engineering professoriate is only 64 when there are 722 graduates from the 113 R1 or 1005 from all R1/R2/R3 schools in the past 5 years alone. The previous statement does not suggest that the number of black students pursuing PhD degrees is at a comfortable level. More black students pursuing PhDs in engineering is in fact needed to further expand the pool of diverse applicants for faculty positions in R1 institutions or other government and industry jobs. However, the "pipeline" is not as small as it is perceived to be in many discussions.

While the "pipeline" can always be bigger, it is reasonable to ask if R1 institutions are aggressively pursuing existing black PhD graduates to expand the pool of diverse applicants for new tenure-line faculty positions. Are R1 institutions targeting minority candidates outside of traditional advertising or looking beyond simply adding a footnote such as, "Women and minorities are encouraged to apply"? How many R1 engineering schools are really committed to move beyond paying lip service? As an example, the author was a New Mexico-Alliance for Graduate Engineering and the Professoriate (NM-AGEP) fellow who attended the Institute on Teaching and Mentoring (ITM) more than 15 years ago that perked his interest in joining the engineering professoriate. ITM is still running to this day and it is by far the largest gathering of racial/ethnic minority PhD scholars who are interested in faculty careers in academia, including many McNair Scholars. A closer examination of the 2019 ITM roster reveals that only 36 of the 113 R1 schools studied in this paper sent college representatives to this important gathering. This does not inspire confidence about the commitment of the engineering professoriate to move beyond symbolic gestures and addressing this disparity.

Much has been written about strategies and practices that can promote a more robust applicant pool and a fairer selection process [4]. Lessons can be learned from institutions across the country who are using successful evidence-based practices for inclusive faculty hiring. For

example, the University of Maryland's Inclusive Hiring Pilot Program, based on work funded by the NSF ADVANCE program, provides top 10 evidence-based practices where colleges within its institution can make the commitment to participate in the program. This has resulted in positive outcomes in all categories, including black engineering faculty. One of the strategies implemented is the use of *search-specific* data card including demographics information about one's own university faculty; peer institution faculty at the department level; candidate pool information from previous departmental searches; and recent graduates' data within the discipline. The data card is a tool used to develop a search plan and then inform recruitment and development of a hiring strategy to yield the best pool of candidates that includes minority prospective faculty. This proactive approach can lead to collaborative work between search committees and administrators. However, blaming search committees alone for not presenting a diverse pool of candidates for hiring decisions to be made up the chain is insincere if committee members are not included early on in the development of faculty search plans, do not have a proactive voice in the recruitment strategy, and are not given direct resources to be innovative in the areas of non-traditional advertising that may be required to reach out to minority faculty and expand the pool of applicants.

It is also not clear how many R1 institutions have a mechanism to collect/document the experiences of search committee members and using that information to refine future search committee undertakings. Briggs [5] presented perceptions of seven black faculty members (discipline undisclosed) who have participated in search committees and discussed their institution's hiring policies from their perspectives using Narrative Inquiry. Among others themes, faculty have expressed the rhetoric fatigue of diversity and inclusion versus the commitment of their respective college.

More research effort is also needed to capture black engineering PhD students' and recent graduates' perception about a career in academia, particularly in R1 schools (this is true for all underrepresented minority groups). As an example, Ebony et al. [6] presented preliminary results on the barriers and opportunities facing a cohort of 49 black engineering PhD students and 2 postdocs through a combination of private interviews and student focus groups. While the sample size is small, many students expressed negative perceptions about academia. Some expressed experiencing marginalization and facing institutional racism during their studies (why would they return to the same environment that marginalizes them except to be brave and fight the same marginalization for future students?). Even from those interested in joining academia, many preferred to join teaching institutions and/or HBCUs. For some, serving as a role model for younger generations and tackling disparities were priority rather than conducting research. Many of the participants stated that they would be more open to considering tenure-track positions if there was a mentoring program specifically focused on preparing them for a career in the professoriate. It will be useful to determine the proportion of underrepresented minority students who are attending workshops or training that focus on a career in academia in institutions that offer these programs.

In this work in progress paper, the phrase "net increase of 64 faculty" appeared repeatedly. No attempt was made to capture the retention aspect of black engineering faculty [8]. Gumpertz et

al. [8] studied the retention and promotion of underrepresented STEM faculty in four large grant R1 institutions from 1992 to 2015. They stressed the need to understand the large impact that a departure of faculty from an already small group can have in the overall professoriate. However, they were unable to make conclusions about retention given the small number of underrepresented faculty. In the process of investigating retention, they have quantified and highlighted that black STEM faculty have not been hired in same proportions as those that earned PhDs in STEM disciplines, a finding similar to what is reported in this paper. Overall, much work is needed in hiring practices and empirical research to address the disparity of black tenure-line engineering faculty representation.

Conclusion

This work-in-progress paper presents preliminary findings on the state of tenure-line black engineering faculty in research-intensive (R1) universities during 2014-2018. The hiring trends are slightly up for black tenure-line engineering faculty with a stagnant proportional rate of percentage increase. More work is needed from all constituents if the engineering professoriate wishes to have a "notable" increase in the number of black tenure-line faculty that will be needed to achieve the ASEE pledge of "notable increase in the overall diversity" in this new decade. The "pipeline problem" narrative was examined to provide a perspective on the '"pipe size" that is significantly underutilized. Preliminary thoughts are provided on hiring practices and the need for empirical research.

Acknowledgment

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