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Building stronger faculty-industry engagement for enriched applied engineering education

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Building strong faculty-industry engagement for enriched applied engineering education

The purpose of the paper is to identify strategies to encourage and facilitate stronger industry engagement among engineering faculty. A continuous engagement between industry and faculty is essential for faculty to understand current best practices in the industry and build stronger linkages with theories and concepts. This knowledge, when brought back to the classroom, enriches students with practical skills and abilities to be successful in their careers. Additionally, engaging and working with the industry to design solutions helps higher education institutions fulfill their broader mission of advancing research, providing meaningful education, and promoting lifelong learning.

Problem

Traditional industry-university collaborations in engineering have focused on collaborating on capstone projects or large research and development collaborations to design and develop new products and processes. However, most small and medium-sized companies need greater hands-on support and assistance as they need pragmatic solutions that can be developed quickly at optimal costs. Industry expectations of project outcomes and timelines also do not always align with the preferred outcomes that facilitate faculty's professional growth and success. Industry partners, faculty, and higher education administrators are aware of the barriers that prevent a high level of industry-faculty partnership over time. To address these barriers, the current effort garnered faculty perspectives on the causes, including contributing environmental and organizational factors. As the higher education landscape changes with increasing market pressures, it is important to find ways to engage faculty, identify career goals, and their motivations, and enhance both organizational and individual success. We draw from faculty development literature, with a specific focus on career success. How faculty define and understand career success is critical for finding support for initiatives such as industry engagement which is important, but not essential for faculty promotion and tenure.

Defining Career Success

Career success has been defined as the positive psychological outcomes (work-related) and achievements gained through work experiences (Judge et al., 1995; Rasdi et al., 2011). Previous research commonly classified career success into objective and subjective (Dries, 2011; Heslin, 2005; Ng et al., 2005; Rasdi et al., 2011; Santos, 2016; Seibert et al., 2024; Sherif et al., 2020) categories. From an objective perspective, career success is viewed from the outside – measured by external indicators such as achievements (e.g., promotions or salary). The external perspective accounts for a socialized view of a career, where peers, supervisors, and other stakeholders participate in the collective acknowledgment, recognition, and to some extent assessment of one’s contributions. Subjective career success, in contrast, refers to personal evaluations and feelings about career outcomes, that are centered on the individual. This latter perspective takes an internalized view of success, where an individual’s values, and motivations, and attitudes shape their success. Additionally, a third view – the constructivist perspective argues that career success is socially constructed. In this view, career success is not static but rather socially constructed by personal values, individual decisions, and expectations with broader structural and contextual influences (Dries et al., 2008; Santos, 2016). The constructivist

view to some extent combines and integrates the objective and subjective perspectives on career success.

Within the context of tenure and tenure-track faculty in engineering, it is important to identify objective and subjective measures of career success. For example, objective measures of faculty success are reflected in the emphasis placed on faculty to establish a steady stream of funding that will sustain a research agenda. Funding agencies such as NSF and DoD are favored as they support the hiring and training of students, working on publications, and developing future faculty through funding. Few companies can invest in research and development in the context of industry-faculty partnerships and engagement. In applied engineering disciplines, it becomes clear that the industry does not have an incentive to support a sustained research agenda. The misalignment of goals naturally does not lend to collaboration.

Faculty Career Success

In the context of higher education, faculty are typically drawn to the creation of knowledge through research and the education of students through teaching and mentorship. Loosely, the former track of appeals to tenure-track faculty while the latter is a component of most faculty positions, including professional faculty who are typically drawn from the industry. Service also comes as an ancillary area of responsibility but is less relevant to this article. To inform our conversation, we can partition faculty into two groups, tenure-track faculty members who support the dual mission of the institution, and professional-track faculty who focus primarily on the educational mission of the institution. We recognize that roles and responsibilities of faculty are much more nuance than this partition; yet, for the sake of exposition, these distinctions are sufficient to establish a context. The goals of each faculty group are somewhat different, and the objective measures of career success research productivity and teaching proficiency for the tenure-stream faculty, whereas teaching outputs and integration with practice often characterize the contributions of professional-track faculty groups. Both tracks emphasize differing core competencies and professional networks (DeFillippi & Arthur, 1994). Recent conceptualizations also acknowledge shifting from traditional expectations and boundaries defining faculty success. For example, Beigi et al. (2018) conceptualized academic careers as boundaryless, characterized by fluid job boundaries, high mobility, and diverse professional networks. Mobility, a core component of boundaryless career theory, refers to interorganizational movement that enhances subjective career success by fostering autonomy, validating personal accomplishments, and providing an opportunity to escape toxic work environments, ultimately improving career satisfaction (Varela et al., 2023). However, the impact of mobility is moderated by the industry segment, suggesting that the significance of early career movements varies depending on the context.

Within the context of boundaryless career theory, the scholars emphasized core competency-based perspectives underlining the knowledge-driven nature of faculty careers (Beigi et al., 2018). Identifying the dimensions of (1) know-why (culture), (2) know-how (skills), and (3) know-whom (networks), would be essential in shaping career success across organizational boundaries. Identifying the significance of the above three dimensions and specific elements would contribute to achieving exceptional success in academic careers. From our theoretical perspective framing of career success in terms of subjective and objective measures, know-how

(skills) lends itself to be captured using objective measures of success. The remaining two dimensions are amenable to both subjective and objective assessments of career success.

Emphasizing the importance of the subjective dimension of career success in academia, Sherif et al. (2020) found that successful faculty were able to leverage social relationships and resources to advance their careers. In contrast, those who lacked these competencies were often limited in their social connections, which hindered their professional progress. Faculty need to develop professional competence, leadership abilities, and entrepreneurial motivation to effectively mobilize social resources for career advancement (e.g., Seibert et al., 2024). Thus, know-how skills need alone would be insufficient to support faculty advancement. The critical role of networking and resource management shapes academic success.

Santos (2016) explored the factors influencing academics' perceptions of career success, focusing on the barriers such as poor workplace relationships, lack of organizational support, job insecurity, and unclear career progression expectations. Personal factors, including the pursuit of work-life balance and gender ideology, were also significant contributors to career success. For tenure track faculty, building on established research networks with their dissertation advisor/mentor is critical for navigating peer networks in their discipline. In their formative development as a scholar, early career faculty benefit from existing networks of their faculty mentors and if these networks involved industry stakeholder, the overall engagement with scholars and industry practitioners would support career advancement, especially for tenure track faculty. The findings underscore the complex interplay of structural and individual factors that shape academic career outcomes, highlighting that success may depend largely on an academic's ability to navigate national and international social networks and adhere to the expectations of their peer group. This emphasizes the importance of both personal and external factors in determining career advancement in academia.

In contrast, professional-track faculty members experience different challenges and opportunities in comparison to their tenured counterparts. Kraimer et al. (2019) utilized a job demands-resources perspective and identified work stressors such as family-to-work conflict and role overload as factors that negatively impact career satisfaction through work engagement. Not surprisingly, both positive and negative career shocks influence career satisfaction and salary. Professional-track faculty members who were denied tenure in the past were found to be less satisfied with their career paths, and additional or extra role support was found to be beneficial. Networking, mentorship, and professional development can help professional faculty feel more included and supported.

Career opportunities, such as leadership roles and promotions, are significantly affected by social capital and interpersonal relationships (Han et al., 2023). Clinical faculty often have limited access to professional development, hindering their promotion prospects. As clinical practice generates much of the revenue for certain colleges (e.g., medical schools), those workplace environments typically hire more clinical/professional faculty than other academic units. Non-tenured faculty members face the challenges of navigating the dual responsibilities of practitioner (or clinical) and academic work while meeting promotion criteria that tends to recognize and value the contributions of research-focused faculty over their own.

On similar lines, Seibert et al., (2024) and Han et al., (2023) also identified power imbalances among specialty or disciplinary areas, which can weaken the culture of collaboration. Despite initiatives aimed at balancing the importance of teaching and service, publishing remains a dominant focus of research-intensive universities. To support career success, scholars recommend greater transparency, equity, inclusivity, and stronger relationships based on mutual respect between faculty and leaders. Research also shows that gender plays a significant role in shaping definitions of career success. Studies indicate that women often place more value on achieving work-life balance, while men tend to prioritize objective measures of career success (Afiouni & Karam, 2014; Dolan et al., 2011; Dyke & Murphy, 2006). Thus, a complex set of factors at individual, institutional/organizational, and environmental levels contribute to the lack of sustained high-level engagement with industry in the long term.

Faculty career success literature highlights the complex interplay between individual competencies, organizational support, social networks, and environmental factors. Developing competencies like leadership and professional skills is crucial for advancing in boundaryless academic careers (Beigi et al., 2018; Sherif et al., 2020). According to Varela and Premeaux (2023), research achievements are the primary factor influencing both objective (e.g., salary) and subjective (e.g., satisfaction) indicators of career success. Networking and social capital are key to academic career success, as faculty who leverage organizational resources are more likely to advance (Sherif et al., 2020; Kraimer et al., 2019). Barriers such as job insecurity, workplace relationships, and gender bias can significantly affect academic career outcomes (Santos, 2016; Han et al., 2023). In terms of organizational support, mentorship, networking opportunities, professional development programs, and clear, transparent, and inclusive promotion processes are essential for supporting faculty (Kraimer et al., 2019; Han et al., 2023).

Methods

To explore factors that support or hinder faculty engagement with industry and recommend strategies for bridging potential gaps in their collaboration, a survey was conducted. The survey utilized 7 open-ended questions to elicit responses from 9 faculty in a single engineering department at a Research 1 university located in the southern U.S. The questions were developed by Thompson and Tracy (2011), addressed the following key areas: a) status of industry engagement, b) factors contributing to current status, c) vision and goals for the future to establish deep engagement with industry, d) exploration of barriers and constraints limiting industry engagement, and e) identification of additional skills, knowledge, skills, or resources that would be required to achieve strategic engagement and be a leader in the field. Faculty responded to each of these topic areas in a few sentences.

Thematic Analysis

We identified six themes as they relate to faculty perspectives on the status of industry engagement initiatives and potential opportunities for enhancing them. The themes identified are as follows: a) current status of the partnerships; b) root cause for current levels of engagement; c) opportunities and constraints; d) identifying organizational and individual capacities for fostering industry engagement; e) future goals; f) idealizing a perfect industry partnership.

Current Status of Partnerships

Industry partnerships form the cornerstone of providing internships and capstone projects that enhance outside classroom experiences for students. For example, one professional faculty shared an example of such a partnership: “We are partnering with small communities to do IT Service assessments as part of our capstone. We also have industry partners that provide internships.” In addition, industry partners also engaged with students and faculty through planned guest lectures to supplement core content and curriculum. Faculty also expressed concern as key faculty who had led industry-wide engagement were retiring, which was likely to put industry engagement at risk.

On the other hand, tenure-stream faculty who were yet to achieve tenure shared somewhat different perceptions of the department’s current relationship with the industry. Tenure stream faculty acknowledged that industry engagement was primarily limited to professional-track faculty and faculty of practice. The engagement activities focused on guest speaking activities as the non-tenure stream faculty. Importantly, the tenure-stream faculty shared examples where their technologies were licensed to a local company. Faculty also suggested that established relationships with industry partners tended to be “owned” by individual faculty who benefited from these partnerships which offered additional value and benefited their position and status. Tenured faculty did not share specifics of industry-led engagement except for observing that high level of engagement and that level of engagement was comparatively better than other engineering departments.

Root causes for current level of engagement

Professional faculty raised more questions concerning the potential causes for the current status of industry engagement – which appeared to rely on historical success and the leadership of 1-2 faculty, who lead various consortium initiatives. The department had expanded to include new programs, and identifying proper industry partners for new initiatives was unclear and somewhat lacking. For example, understanding market needs and incentives to sustain new partnerships was ill-defined. Potential grant opportunities were not considered attractive, as the overall funding amounts were smaller than traditional research grant opportunities.

Faculty perceived they were discouraged from pursuing these opportunities as opposed to traditional research grant activities, which were encouraged by the department and institution. In these circumstances, metrics defining outreach activities, and identifying reliable industry partners were not surprisingly unclear. Faculty who were called to lead established industry relationships for the department fostered program development. Professional faculty mentioned the role of alumni and their interest in advising faculty on innovative technology and advancements.

Limiting opportunities and constraints for industry engagement

Professional faculty offered a more inclusive and grounded approach to the issue that included faculty broadly, regardless of their respective tracks. They indicated the need for time, and organization to align research interests and funding priorities. They also stressed how much the industry valued engaging with faculty, and overall, there was a need to use time and resources wisely in service of industry priorities to integrate academic research with innovations from the industry. They emphasized an industry-centered approach; the end goal was thus to win the engagement of industry leaders and managers.

Tenure stream faculty identified lack of consistent, prolonged and ongoing communication between faculty and industry partners. Faculty and institutional (academic) priorities appeared to conflict with industry and limit engagement and extent of faculty involvement over time. According to a faculty, “They don't know who we are and what we can do. Also, they need to understand the limits of their involvement. Yes, we are selling our services to them, but we are still an academic institution.” Industry constraints were acknowledged as well. People from the industry “have limited bandwidth, as do those seeking tenure. Finding ways to facilitate meaningful interactions and resource sharing presents a challenge.”

Other faculty emphasized the need for more resources in terms of people, incentives to identify and sustain long-term industry partners, or simply protecting time through course release to enhance engagement.

Identifying organizational and individual capacities for fostering industry engagement

Professional faculty identified organizational resources. Specifically, financial resources could expand marketing activities, and coordinate industry engagement efforts. These efforts would nurture existing partnerships. They acknowledged current social media through LinkedIn and showcased industry-engaged initiatives. Additional organization of faculty expertise could promote professional development activities with industry.

There was consensus among faculty for the need for marketing support to produce content translate research and enhance its relevance for practice. Other areas of consensus included the need for deep understanding of what industry partners valued and needs, their attitudes and commitment to engaging with faculty.

In terms of individual skills and expertise, evidence-based research that supported practice would support engagement. One faculty shared: “I believe the most important skill is to be able to sell your idea to the industry and know their (industry) critical needs.”

Tenure stream faculty also identified more institutional support from the college to coordinate organizational efforts for identifying potential funding opportunities.

Future Goals

Future goals were more specific concerning student learning, with expectations of linking research expertise (e.g., IT Service Assessment strategies) to benefit small rural communities. These activities would supplement ongoing support for internships and placements and develop graduates to meet the future needs of the industry. Faculty also recommended having a strategic plan to prioritize industry relationships, identify stakeholders in the industry, and also among their faculty colleagues to identify how plans for effective industry engagement could be initiated and maintained over time.

Along similar lines, tenure-stream faculty recognized the value of industry relationships. Idealizing productive relationships with industry, a faculty stressed the need to link “theories, frameworks, concepts, ideas, and solutions” with practical and contextual information emanating from industry. Guided by these linkages, research budgets and needs could define projects involving academe and industry and create learning opportunities for a broader community involving students, faculty, and industry practitioners. Tenured faculty recommended involving new faculty hires, engaging with those industry partners who were interested in funding projects.

Idealizing Industry Engagement for the Future

Professional faculty recommended leveraging community engagements whether this was creating “a community […] of educators, growing [programs], and constantly evaluating” their effectiveness. Along similar lines as tenure-stream faculty, faculty suggested facilitating an internal strategic planning exercise among faculty to identify and invite companies and individuals, develop an action plan, and codify and implement the engagement strategy. In the short term, engagement activities could occur during career fairs. One faculty recommended creating a "Center for Industry-University Engagement" funded by industry (such as the DoD) to achieve lasting collaborative partnerships.

Specific recommendations from tenure-stream faculty included the creation of a task force to facilitate and coordinate industry partnerships through all stages of establishing a healthy relationship. Faculty attempted to describe industry-faculty partnerships in different ways. Faculty agreed that developing partnerships that could be described as mutual, equitable, and beneficial for all stakeholders was in their best interests. Several faculty members offered examples to enhance reciprocity in the relationship. For one faculty, it was “to be more present at their physical place. They come to our class, we need to go to their offices and present all the solutions we can offer.”

The faculty suggested offering expertise through professional outreach, consulting services, and training opportunities for industry managers and workers. This would require faculty to understand the companies and their markets. They highlighted the need to link advisory boards and alumni ties with student organizations and engage in formal internship programs in addition to placement services for students. Important questions on the overall strategic objectives of an industry engagement were also raised to identify gaps, opportunities, and resources to advance the engagement. Tenured faculty pointed out the small size of industry support and recommended the College reduce indirect costs, especially those that involved industry-supported projects. Moreover, initiation grants for new faculty who had no prior industry involvement would underscore institutional support for industry-academic collaborations in the long term.

Recommendations

The findings suggest that there are several beneficial outcomes for faculty, industry partners, students, and other university stakeholders.

Faculty responses were varied in the ways they understood and experienced collaborations with industry. Some faculty reported having well-established connections with industry while others were still developing them. Faculty responses also varied in the examples they shared about industry engagement. For example, industry involvement differed across programs and was facilitated through activities such as guest speakers, collaborative projects, capstone project sponsorship, and internship opportunities. In some cases, the partnerships relied significantly on fewer faculty members, who had deep relationships with the industry. Thus, the broader collaboration or continued engagement was limited for a majority of faculty.

Faculty also identified barriers such as communication issues, and a lack of understanding industry needs to establish a healthy partnership. In addition, faculty also reported resource limitations as well the challenges of maintaining a research focus (on publications and grant

success) which came in the way of establishing collaborations with industry. A recommendation was to pair tenure stream and professional faculty to collaborate on research-to-practice projects with industry to enhance partnerships internal to the university and outside.

Faculty recommended strategies for enhancing collaboration in the following ways. They recommended expanded internship and recruitment opportunities, identifying classroom projects to enhance student learning, and creating shared knowledge in the process. In addition, the faculty recommended additional support to enhance industry engagement. These include establishing a task force that would elicit program and industry feedback for improving the engagement from both sides, identifying financial support and incentives for those willing to leverage networks and identify quality partners, increasing presence in the industry, and engaging the community.

As a next step, our goal is to gain a more in-depth understanding of faculty perspectives using focus groups. Our paper positions the faculty focus from a career well-being standpoint as a potential way to enhance faculty interest and motivation in developing and managing long-term sustainable partnerships with small to medium enterprises.

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