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Abstract

Today's technical workplace requires the presence or involvement of engineers, scientists, and technical employees with various academic preparations to solve the complex challenges faced by forward-leaning businesses. As organizations strategically position themselves to become globally competitive and sustainable, sourcing and acquiring strong technical talent is essential. Making this charge more daunting is the perceived, and in some cases real, shortage of talent. While policy makers and pundits may disagree on this issue, research performed in early 2011 by Aberdeen Group's Human Capital Management division indicates that companies have realized that the ability to locate and land top talent will be one of their competitive differentiators[1].

In fact, another recent survey by ManpowerGroup stated that engineering positions were the third hardest jobs to fill for U.S. companies. Applicants' lack of appropriate skills or experience was the primary driver for the talent shortage[2]. Given this backdrop, academic institutions must ready themselves to supply organizations with the appropriate human capital necessary to design and produce innovative products and services needed to become and remain competitive in a global marketplace. To that end, one source of untapped talent lies in the Engineering Technology community. Engineers and Engineering Technologists often work side by side in the workplace performing similar, if not identical, technical functions. Unfortunately, there exist a great number of organizations that are unaware of the true technical capabilities of Engineering Technologists. The balance of this paper will discuss data collected from surveys and interviews with Engineering Managers, Human Resource Managers, and Campus Recruiters charged with sourcing and acquiring baccalaureate-level technical talent and the potential role of Engineering Technologists in meeting this need.

Introduction

During the 2010/2011 academic year, the author participated in a collaborative project between Rose-Hulman Institute of Technology and Ivy Tech Community College, Terre Haute campus. The opportunity sought to provide engineering and technology students with project experience focused on a new product development process that is truly reflective of the 21st century workplace. A primary goal of the project was to provide students with an educational experience that mirrored their potential work environment in terms of technical rigor, managerial responsibility, and professional skills (communication, leadership, teamwork, etc.). However, an additional opportunity, focused on Human Capital Management, presented itself during the project that.

In the initial stages of the project the Principle Investors experienced difficulty in acquiring the right combination of students to participate in the project. As one of the Engineering Managers of the project, the author began to wonder about contemporary hiring practices related to Engineers and Engineering Technologists. More specifically, the researcher ventured to uncover

the issues faced by Engineering and Engineering Technologists when seeking employment in the private-sector. To achieve this goal the author queried multiple private-sector organizations and placement agencies to acquire data to inform the research.

Literature Review

Throughout the past decade there has been a growing internal petition for the United States to produce more engineers. High and Nowakowski[3] (2011) noted this refrain is commonly spoken by CEOs, government officials (including the President), human resource professionals and the like. For example, Paul Otellini, a member of the President's Council on Jobs and Competitiveness remarked, a chronic shortage of engineering students threatens America's role as the world's leading innovator and continues to impede our nation's fragile economic recovery[4]. Past ASEE President Ronald Barr stated in 2005, engineers are vital both to protecting this nation's key infrastructures from attack and to keeping our economy strong[5]. While there are many groups who promote this belief, there is a lack of comprehensive measures to universally support the claims. If there is any validity to the claim, which there is, a response is warranted. Rather than engage in political hypothesis or a statistical analysis that partitions the workforce data to the author's resolve, a more practical solution was investigated in this preliminary research. Since there are many ways to slice the data and categorize engineers, the following sections will provide operational definitions for the two disciplines (Engineering and Engineering Technology) discussed in the remainder of the paper.

Engineers

On the occupational spectrum for technical employees, typically engineers are the persons who operate in the research, design, and analysis areas. ABET, Inc's definition of engineering is the profession in which knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to economically use the materials and forces of nature for the benefit of mankind[6]. Furthermore, some will describe engineers as the organizational "innovators" who propose solutions to complex, open-ended, design matters. Engineering education leading to a Bachelor of Science degree is predicated on a plan of study which includes calculus, differential equations, calculus-based theoretical science courses coupled with engineering science, design, and analysis.

Engineering Technologists

Engineering Technologists also possess a Bachelor of Science in their area of specialization; which allows for natural alignment between Engineering Technology curricula and those of classical Engineering disciplines. Nearly all engineering degrees have a technology degree counterpart. One of the most commonly pursued technology degrees is the Mechanical Engineering Technology degree followed closely by Electrical Engineering Technology. Dubbed the "implementers," Technologists typically undertake a four-year course of study that focuses on the applied aspects of science and engineering principles. Generally speaking, most

Engineering Technology curricula do not include higher levels of mathematics and calculus-based science nor do they delve deeply into the scientific theories of engineering.

These attributes serve as the distinguishing characteristics between the Engineering and Engineering Technology degree categories. ABET further clarifies this distinction in its description of Engineering Technology as the part of the technological field that requires the application of scientific and engineering knowledge combined with technical skills in support of engineering activities; it lies in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer[7]. It is upon this statement that the author believes an interim solution can be forged to offset the shortage of engineers.

The Study

In the following sections information from a three-month study of private-sector organizations seeking to hire technical employees will be presented. Each organization studied was actively seeking to fill entry-level engineering positions. In most cases, applicants were required to possess a Bachelor of Science in Engineering for the position. After discussing the organizational needs and reviewing the job descriptions, representatives were asked if they ever considered hiring an Engineering Technologist to fill the position.

Methodology

The intention of this exploratory study was to better understand Human Resource Management (HRM) practices related to the hiring of Engineers and Engineering Technologists in a manner that can serve both academics and practitioners. Attempting to understand the development of strategic and functional HRM constructs requires a holistic research approach. These approaches must include both quantitative and qualitative data derived from multiple collection techniques. It has been stated that both quantitative and qualitative research methods help researchers understand issues better than either of the two separately[8]. Further, Kiessling and Harvey (2005) suggested that quantitative analysis in understanding and explaining HRM practices is not sufficient, a mixed-method (combining both quantitative and qualitative) approach provides the insight truly desired[9].

Face-to-face interviews and electronic communication (email and telephone conversations) were utilized to obtain the largest portion of the qualitative data. The author conducted 14 face-to-face discussions with Engineering Managers (6), Human Resource Managers (4), Executive Recruiting Agents (2), and Campus Recruiters (2). During each of the interviews, participants were asked if they had or were actively seeking to fill entry-level technical positions. All responded affirmatively and noted they anticipated filling the positions prior to the end of 2011 calendar year. Additionally, interviewees discussed job descriptions and their ideal candidates for the positions that were currently being advertised. These interviews yielded substantive information. To complement and corroborate the qualitative data obtained from the interviews, a brief three-item survey was administered to a larger population of recruiters, approximately 165,

visiting the RHIT fall Career Fair. With the exception of Executive Recruiters (not present at the Career Fair), the larger group contained similar demographics to face-to-face interviews.

The quantitative aspect of this endeavor asked participants to answer the following questions:

1. Do you know the difference between Engineering and Engineering Technology Baccalaureate Degrees (e.g. Mechanical Engineering vs. Mechanical Engineering Technology)?
2. Does your organization hire Engineering Technology (Bachelor Science) Graduates?
3. If yes, in what capacity (i.e. Engineering, Maintenance, Technical Support, etc.)?

The brevity of the questionnaire was critical since it was embedded in a larger survey that participants were provided prior to their visit to campus. Before deploying the instrument, the Offices of Institutional Research, Planning and Assessment (IRPA) and Career Services reviewed the items for appropriateness, format, item clarity, and ease of use. After incorporating the suggestions, the instrument was finalized and administered. Participants were given a two-week window of opportunity, a week before and after their campus visit, to respond to the survey. The qualitative and quantitative results are discussed in the following sections.

Qualitative Findings

To maintain data integrity the three survey questions were again used during the face-to-face interviews. After completing 14 interviews, the majority (12) of interviewees stated they had not previously recruited or hired Engineering Technologist for entry-level technical positions. When asked to elaborate interviewees provided an array of reasons for their hiring practice. Four reasons that were common to the twelve respondents were:

1. The position required an Engineering degree,
2. They have not previously considered an Engineering Technologist,
3. There were no qualified Engineering Technologist applicants, and
4. Candidates should be able to obtain Professional Engineering (PE) certification.

When asked if they employed Engineering Technologists in their organizations, five (5) of the interviewees responded affirmatively. The Technologists were experienced employees with responsibilities in production, operations, or maintenance, but not engineering. As the interviews continued, we began discussing the skills necessary for the entry-level technical positions. Most, if not all, interviewees were surprised to learn that a large number of technical and managerial skills they required could actually be accomplished by an Engineering Technologist. In one instance, the entire job description could be completed by an Engineering Technologist. A primary theme uncovered during the interview process indicated that opportunities exist for Engineering Technologists to fulfill some of the entry-level technical positions typically filled by Engineers. Given the limited number of interviewees and the narrow geographic footprint they

represented, a second stage of data collection was employed to obtain a broader perspective on the hiring practices.

Quantitative Findings

A three-question survey instrument was administered by the Office of Career Services and Employer Relations during an on-campus Career Fair in October 2011. The electronic survey was administered to 165 recruiters seeking to fill entry-level technical positions. Forty-nine (49) valid responses were obtained resulting in a 29.7% response rate. While this response rate might be considered "average" to "low," the representation of employers was ideal and returned responses from a diverse cross-section of technical employers. One of the primary reasons contributing to the low response rate was the length of the overall survey in which the three questions were embedded. Given the simplicity of the survey, it is the author's belief that the response rate would have been higher if the items were administered separately. However, the data gathered remains useful for this preliminary study.

Survey Item One asked respondents if participants knew the difference between the Bachelor of Science degree in Engineering and Engineering Technology. Twenty-one participants responded "Yes", 18 responded "No", and 10 were "Unsure." When asked in Item Two, did their organization hire Engineering Technology (Bachelor of Science) graduates the distribution profile was almost equal across responses: Yes – 18, No – 16 and Unsure – 15. Finally, Item Three asked respondents who answered "Yes" to Item Two to describe in what capacity they hire Engineering Technologists. The responses spanned five general categories: Engineering (7), Technical Support (6), Maintenance (7), Operations (4), and Management (2). In several cases participants indicated they employed Engineering Technologists in multiple roles. This caused the total number of responses to be greater that the total number of respondents. A tabular depiction of this information is offered below.

Table 1. Survey Responses (n = 49)

Do you know the difference between the Engineering and Engineering Technology Baccalaureate Degree (e.g. Mechanical Engineering vs. Mechanical Engineering Technology)?	Yes	No	Unsure
	42.9% (21)	36.7% (18)	20.4% (10)
Does your organization hire Engineering Technology (Bachelor Science) Graduates?	Yes	No	Unsure
	36.7% (18)	32.7% (16)	30.6% (15)
If yes, in what capacity (i.e. Engineering, Maintenance, Technical Support, etc.)?	Engineering (7) Technical Support (6) Maintenance (7) Operations (4) Production Management (2)		

The findings of the quantitative results are informative and expound upon the information gathered during the face-to-face interviews. One of the key results of these preliminary findings highlighted the significant number of hiring agents that are unaware of the technical capabilities of Engineering Technologists. Further, this mixed-method research provides support for a larger, more detailed, study of hiring practices related to Engineers and Engineering Technologists for entry-level technical positions. Although Engineers and Engineering Technologists are not academic equals, there is considerable overlap in their technical and professional offerings to an organization.

Conclusion

The roles and responsibilities of today's technical workforce are constantly changing to match business needs. As such, Engineering Managers, Human Resource Managers, and the like must be willing to objectively analyze workplace needs to determine the appropriate human capital profile. As Wil Davis remarked in Creating a Culture of Excellence, the only truly unique, sustainable competitive advantage that any organization has is in the unique, unduplicated [diverse] intellectual capital of its people[10]. Diverse engineering teams harness differing perspectives and ideas that individuals bring to the workplace in a complementary fashion for innovation and problem-solving success—two critical elements needed to survive in today's global marketplace. Keep in mind that résumés only partially reflect potential and degree titles should not be the primary proxy for skill and competency. Hiring must be based on each candidate's display of competence and ability to fulfill an organization's current and future technical needs.

The differences in academic preparation and professional contributions of Engineers and Engineering Technologists are undisputed. However, their skill sets are not mutually exclusive. There exist a recognizable overlap in the skill sets of Engineers and Engineering Technologist that can be brought to bear in response to workplace demands. Some of the concerns uncovered during this preliminary research are valid, but can be overcome. It is necessary to recruit broadly to achieve the technical diversity required to be successful. The results of this preliminary study have indicated there is an opportunity within an organization's technical space to offset the "shortage" of engineers by considering the talent offering of the 14,500 Engineering Technologists graduating annually[11]. Most, if not all, real-world technical assignments (projects) require input and interaction from various disciplines both in and outside of traditional engineering spheres. Therefore, it is vital to decompose job descriptions/positions to a finer granularity such that Engineering Managers can assemble a workforce (engineers and technologists) that parallels the true needs of an organization. Going forward, sourcing and selection practices must continue to evolve and accurately reflect organizational needs rather than continue to operate in traditional practices. When recruiting potential talent for the current and future workforce, the objective must be to identify and acquire talent, not just titles. Otherwise, we run the risk of continuing to overlook a population of technically-capable

resources that stands ready to contribute to an organization's and on a larger scale or nation's success.

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