Work Experiences of Engineering Managers: Challenges, Strategies, Competencies

Swetha Nittala
School of Engineering Education
Purdue University
West Lafayette, IN, USA
snittala@purdue.edu

Brent K. Jesiek
School of Engineering Education
Purdue University
West Lafayette, IN, USA
bjesiek@purdue.edu

***Abstract*—In this work in progress paper, we discuss how engineers make sense of their experiences in transitioning to managerial/leadership roles. Developing engineering talent in organizations has long been an issue for industries. Notably, with rapidly changing business models and flattened organizational structures, engineers are required to transition into managerial and leadership roles more quickly than ever before. Yet engineers and employers alike often characterize this as a difficult transition. Further, there remains a lack of empirical research on the nature of engineering managerial work practices. The research project described in this study will address the broader research topic: to holistically uncover the experiences of recently transitioned engineering managers. Specifically, this paper describes the motivation, relevant literature, and methodological approaches to address the primary research question: How do recently transitioned engineering managers make sense of their managerial work experiences? Complimentary and secondary research questions include: 1) What are the challenges faced by engineers as they transitioned into their new roles as engineering managers or leaders?, and 2) What specific competencies and/or strategies did the subjects view as essential for their survival and success at work? This paper presents an overview of the study design, including justifications for the use of relevant methodological frameworks and methods for the research. The paper concludes with a discussion of future work, as well as potential implications such as related to creating training content for professional development of engineers.**

Keywords—career transition; competencies; engineering managers; engineering practice; professional development; work experiences

I. BACKGROUND AND RESEARCHER POSITIONALITY

By the 1990s, it was reported that a majority of engineers were moving into some sort of managerial or leadership role during the first 3-5 years of their careers, regardless of their preferred career track [1]. Additionally, a 2002 survey of professional engineers in the UK found that more than three quarters of respondents were in job roles with a significant or predominant managerial component [2]. As engineers move into such roles, work demands and expectations multiply with the addition of managerial aspects of the work. In fact, findings from one empirical study suggest that the engineering managerial role involves balancing many more responsibilities, tasks and priorities as compared to more traditional technical roles [3]. This typically includes leading teams, delegating work, and managing resources, among other things [3]. Such additions make it imperative for engineers to develop managerial abilities early on in their careers.

While the need for engineers to quickly transition into managerial roles has been clearly established, research also shows that engineers are often ill prepared to fill such roles [1]. For instance, in highlighting the challenges faced by engineers transitioning into managerial roles, Howard [3] notes that engineers are often reluctant to delegate tasks as opposed to doing the tasks themselves. Other scholars have more generally discussed the lack of leadership skills among engineers [4]. Such claims are often confirmed by industry affiliates as well [4].

Moreover, my own (the lead author's) experiences in industry add further weight to such claims, including my interactions and informal interviews with engineering managers as a part of my recent internship experience. While some of these engineering managers talked about the difficulties they faced managing teams, including virtual teams, others talked about difficulties influencing other stakeholders to get their projects approved and budgeted. During the same internship experience, I also conducted informal interviews with Human Resource Development (HRD) managers that were responsible for training engineering mangers. They shared similar perceptions as they reiterated that engineers often struggle to be effective as engineering managers in terms of leading teams, delegating work, and communicating effectively. Although these personal observations may be anecdotal and limited to the views of a few individuals from a single company, they certainly seem to have resonance with a small but growing body of scholarly literature as noted earlier. These experiences shape my own positionality in framing the research and study.

Some of the challenges and unpreparedness faced by engineers transitioning into engineering managerial roles can in part be attributed to the current engineering education system. Engineering educators in recent times have been vocal in pointing out these gaps. For instance, Trevelyan [5] suggests that engineering education has been falling short in preparing next generation engineers, namely by only catering to produce engineers that are technically adept with little or no social skills. While revised ABET accreditation requirements continue to challenge the engineering education system to work towards producing engineers with broader professional skills [6], there is still very little research on engineering managerial practice and the challenges engineering managerial

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professionals face in their job roles. This study intends to address some of these concerns by exploring the lived experiences of recently transitioned engineering managers, with the findings potentially informing how engineering educators and industry can better prepare engineers for management roles.

In the following sections, we discuss the relevant literature and background as further motivation for the study. Additionally, we propose specific methodologies and frameworks that will be relevant to address the research questions, followed by a brief summary of the implications of the proposed work.

II. Literature Review

A. Engineer to Manager Career Transition

Career transition, as defined by Louis refers to the "period in which the individual is either changing roles (taking on a different objective role) or changing orientation to a role already held (altering a subjective state)" [7, p.330]. More recent definitions have broadened the scope further by defining career transition as a process of engagement and disengagement from one work situation to another [8]. Not surprisingly, such broad definitions on the topic have led researchers to focus on and cover a wide range of topics under the broader umbrella of career transition [8], [9]. However, for this study, career transition will be viewed as the transition from a lower position to a higher position, such as a shift from being an individual contributor to a manager [10]. Specifically, the focus will be on the transition from an engineer to a manager role.

There have been numerous studies to date in the management and human resource fields focusing on the transition from an individual contributor role to a managerial role [11, Ch. 1]. However, research more specifically focused on the transition from an engineering role to a managerial role remains scant, both in the general management and engineering management fields [3], [12]. Further, these few scholarly studies on the engineer to manager transition vary in their purpose and perspective. For instance, while some have viewed this transition as a one-time event [13], others have viewed it as a process [3], [14]. Moreover, one source has even discussed it as a series of events or as a continuous process [15].

Additionally, while a growing body of literature is concerned with exploring this transition in its exclusivity, some sources have ventured out to describe the transition in relation to other activities such as education, in/formal learning, and socialization [16], [17]. For instance, Wallace [16] emphasized the role of organizational socialization in effective transition for engineering managers. Other researchers such as Bland [17] and Dittman [18] explored the role of education in the transition. Furthermore, a few others such as Bayton and Chapman [19] and Johnson and Sargeant [20] explored the role of motivation and motivational models in transition. And Yeh [21] has more specifically explored the experiences of "derailed managers" or managers that do not transition well.

As an added complexity, the purpose of prior studies has also been vastly different. Whereas some authors adopt a competency approach to study the transition process [13], [22], a few sources have focused on the emotional aspects of the transition [2], [23]. In another line of research, authors have studied the transition from an organizational needs perspective through the human resource management lens [12], [24].

Moreover, despite the striking differences in purpose and perspectives used to study the transition process, the work in the engineer to manager transition domain has mainly been limited to the study of three major topics including: 1) competency and skill needs related to transition [1], [13], [22], 2) challenges associated with the transition [3], [25], and 3) strategies or developmental aspects for an effective transition [13], [14], [16]. However, little attention has been paid to examining holistically the managerial work experiences and practices of recently transitioned engineering managers.

The preceding literature review suggests that research on the engineer to manager transition remains mostly unexplored and incoherent, despite claims of its importance to both individual engineers and organizations more generally. It is further worth noting that there is a visible absence of literature and research on understanding the lived experiences of newly transitioned engineering managers, coupled with a lack of understanding of managerial work practices from the engineering managers' perspectives. However, contemporary research in engineering education suggests that rich descriptions and lived experiences of practicing professionals are crucial in understanding the broader context of practice, including the associated job role challenges and competency demands [26]. Understanding the work experiences of engineering managers can thus help in uncovering underlying aspects such as the competencies, challenges and strategies associated with the transition from an engineer to manger role.

III. Methods

The proposed research aims to uncover the managerial experiences of recently transitioned engineering managers to inform related educational programs and other supporting interventions. Specifically, the following research questions will guide the proposed study:

Primary Research Question:

- (RQ1): How do recently transitioned engineering managers make sense of their managerial work experiences?
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Secondary Research Questions:

- (RQ2): What challenges do engineers face as they transition into engineering managerial roles?
- (RQ3): What specific competencies and/or strategies did the subjects view as essential for their survival and success at work?

A qualitative interpretive study will be used as the methodological framework for the research. As described by Merriam, a basic interpretive qualitative study is often used to "understand how people make sense of their lives and their experiences" [27, p. 38]. With the primary focus of the research being interpretive in nature, owing to the interest to understand

the work experiences and situations from the engineering managers' perceptions, an interpretive qualitative study is well suited to the study's main focus. Moreover, given the motivation to investigate the problem of career transition more holistically, including by uncovering as many underlying factors of career transition as possible, a mode of inquiry such as the basic interpretive studies is well suited for the topic because it offers researchers the flexibility to address a wide range of research questions

To employ a basic interpretive qualitative study for any given study, Merriam [27] proposes a specific process which includes the following major steps:

1) To collect data through interviews, observations or documents,

2) To inductively code the data collected to identify common themes and pattern across the data sources, and

3) To provide rich descriptions of the findings and connecting it back to the relevant literature.

Correspondingly, for this study, the following methods will be employed to answer my research questions. First, to get to the primary goal of understanding the work experiences and situations encountered by recently transitioned engineering managers, semi-structured interviews will be conducted with around 15 subjects.

Specifically, the participants for the study, for the data collection process, will be identified by purposive sampling approaches. The following criteria will be used to determine the eligibility of the participants:

- Must have an engineering or technical degree,
- Must have transitioned form an engineering role to a managerial role in the last 0-3 years,
- Must have an official managerial title or job role,
- Must be in the first managerial role of their careers, and
- Must be working on some sort of technical project(s) in their current role as a manager.

Further, the data collection phase will be inspired mainly by narrative research and critical incident techniques [28]. These methods will be employed to elicit grand narratives or stories of the participants' experiences, which will be used for further analysis to address the research questions presented above.

Although the data collection phase will be geared towards narrative research methods, focusing on participants' stories and specific work incidents, the data analysis phase will be approached through thematic analysis as prescribed by Braun and Clarke [29]. The flexible thematic analysis techniques offered by these authors, and particularly inductive and deductive coding approaches, will be helpful in identifying and synthesizing themes as they relate to the three research questions. Finally, thick and rich descriptions of the findings will be presented, with the goal of connecting them to the literature, models and conceptual frameworks used for the study.

One of the significant advantages of employing a basic interpretive studies approach to the research problem is the flexibility it offers the researcher to answer a wide range of questions. Unlike other modes of inquiry, a basic interpretive study will not limit the researcher to cater to the specific purpose of the methodology used, such as understanding the essence of the phenomena in case of phenomenology or reconstructing a narrative in narrative research. As aptly summarized by Chism, Douglas, and Hilson, a basic interpretive study "lacks the added, specified purpose of a grounded theory design, for example (e.g., the added purpose of theory development), it provides the most flexibility in writing about one's findings" [30, p.52].

Additionally, as noted above, the study design will combine techniques adapted from various modes of inquiry rather than invoking only one specific methodology, Primarily, narrative research and phenomenological interviewing techniques along with qualitative thematic analysis methods will be used together in the data collection and analysis process respectively. In citing the advantages of using a combination of techniques to address research questions, Merriam optimistically suggests that such freedom is offered only by a basic interpretive study. She further adds that a basic interpretive study allows the researcher "to use all structural and/or embedded devices to attain the [this] understanding" [27, p. 58], i.e., an understanding of the human experiences and how we make sense of it in the broader situated context.

Validity and Reliability

Despite many advantages, the lack of specific and definitive guidelines or frameworks prescribed by the basic interpretive qualitative methodology raises potential validity and reliability concerns. However, to combat such issues of validity and reliability, Merriam [27] strongly encourages researchers to be transparent about their study design decisions. Thus, to ensure reliability and validity, appropriate justifications for the selection of specific techniques, models and frameworks will be provided throughout the study. Additionally, the role of the researcher as the interpreter will also be emphasized to give readers a better frame of reference for the interpretive findings [27], [31], thereby limiting the scope of validity concerns. Specifically, I will be critically examining my biases and assumptions prior to the research and also stating them upfront as a part of the researcher positionality to navigate the issues of reliability [27], [30], [31]. Additionally, the framework suggested by Walther, Sochaka, and Kellam [32] for engineering education research will be used as a guideline to check and enhance the quality of the study.

IV. Next Steps and Implications

The immediate next steps for the research include data collection from the proposed 15 participants. In the next phases the collected data will be analyzed and presented through the above-mentioned frameworks and methodologies.

The findings from this study are expected to help engineering educators, engineers, and industry affiliates become more aware of the specific skills and competencies required for contemporary work demands. It will also help them understand the common challenges faced by engineers

during the transition to managerial roles. Through these discussions on work practices, we also hope to bring awareness of the complex socio-technical nature of engineering practice. By placing particular emphasis on the effective strategies employed by engineers to cope with the demands of new work roles, we hope to inform engineering educators and training groups in organizations of better ways to develop engineering talent. Overall, an understanding of the managerial work experiences of engineering managers, along with the challenges and strategies associated with the transition, will help in the creation of training content for managerial and professional development of engineers.

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