

**LIVED EXPERIENCES OF RECENTLY TRANSITIONED ENGINEERING
MANAGERS: AN INTERPRETIVE QUALITATIVE STUDY**

by

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For Krishna who walked this road with me from start to end.

And

*For my parents, sister, grandmom and late grandfather who found happiness in my success at
every step of my life!*

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reproduce/reprint from IEEE for my FIE paper is attached in Appendix F, parts of the SEFI paper used and adapted in this study are duly cited and referenced wherever appropriate within the text, based on the suggestions from the SEFI conference chair.

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ABSTRACT¹

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. To address these issues, this dissertation aims to holistically uncover the experiences of recently transitioned engineering managers. Specifically, the study investigates the meaning-making and experiences of the participants' transitional journeys and also addresses related questions such as what changes and challenges they face during the transition and how they navigate the challenges associated with the transition. The study is examined through the lens of work-role transition frameworks and models that emphasize the role of the individual in the transition.

In order to address the research objectives, an interpretive qualitative study is employed. To explore and understand the lived experiences of recently transitioned engineering managers, I conducted semi-structured interviews with 16 newly transitioned engineering managers at a Telecom firm in the United States. The interviews were then used to develop narrative accounts of participants describing their journeys of transition. The interviews were also analyzed thematically to identify: a) specific patterns in how the participants experience and make sense of their transition to engineering managerial roles; b) changes experienced by engineers during the transition; c) challenges faced by engineers as they transition to managerial roles, and d) new skills developed by participants to navigate the transition.

The findings suggest that most engineers struggled with the transition, especially during the early stages. This difficulty in part stems from the various personal changes that they experience as a result of the transition, changes related to their individual cognitive, physiological, and social aspects. Moreover, the transition experiences are also impacted by both the situational factors of the individual (e.g., demographics, career progression) as well as the organizational factors,

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including HR policies related to training and development, dual pathway offerings, etc. The findings in this study, in part presented as narratives, are expected to contribute to the field of engineering education and practice by providing insights into the experiences of engineering professionals taking up managerial and leadership roles. More specifically, the narratives are expected to serve as examples and provide inspiration for engineers at a variety of career stages. The thematic findings are also expected to help students, engineering educators, engineering leadership faculty, and industry affiliates understand and improve the managerial transition process and associated role expectations, which for the most part, remain largely unexplored.

1. INTRODUCTION²

1.1 Preface

I begin this dissertation by sharing my personal interest and motivation in the research study. Through these detailed accounts of my personal motivation and connection to the research topic, I hope to acknowledge and clarify my positionality as a researcher in this study context. In doing so, I also strive to enhance the trustworthiness of this study, which is a critical component for a qualitative interpretive study such as this. As Merriam suggests, it is vital for qualitative researchers to acknowledge and be transparent about their study design decisions at every stage of research (Merriam, 2002).

My primary goal for pursuing this research stems from my interest in the broader topic of learning and development for engineers and technical workers in the workplace. This interest, in part, could be attributed to my identity, educational background, and other relevant experiences both as an engineer and a human resource professional. My past experiences have always made me question the lack of focused attention, in both research and practice, to the learning and developmental aspects for engineering professionals in particular. While similar thoughts have been echoed by several others, most of these other accounts seem to be limited to blog posts or editorial columns, with very little academic research published in the space. This lack of research further motivates me to address the need to study better ways of developing engineering talent.

As a first step in working towards addressing this need, I conducted a systematized literature review related to managing engineering talent and professional development of technical/engineering workforce (Nittala & Jesiek, 2018a). This study helped me recognize the various facets of developing an engineering workforce that needed attention from the engineering education and practice community. It also confirmed my belief that research on engineering practice and workforce remain largely unexplored, despite evidence of its criticality.

Around the same time, through my involvement as a graduate research assistant with an NSF-funded research project on boundary spanning, I had the chance to delve into some niche

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areas of engineering practice research, including exploring the boundary spanning experiences of early-career engineers and interns (Jesiek, Trellinger, Nittala, & Campbell, 2017; Jesiek, Trellinger, & Nittala, 2017). This research footing provided me with frameworks to approach research focused on the engineering workforce and technical practice. It also helped me understand the nuances of the school to work transition. However, what especially stood out for me was the lack of empirical research on engineering practice beyond school to work transitions and other experiences of early-career engineers. Specifically, I wanted to explore and understand better ways of managing and developing engineers as they moved into higher roles. Eventually, I was inspired to focus my research on engineers who transitioned into managerial roles. In the following sections, I describe in detail my motivation to pursue the study focusing on the engineer to manager transition from my own professional and personal standpoint.

Professionally, my research quest to study a more specific topic related to the engineer to manager transition stems from my internship experience during summer 2017, coupled with my prior research experiences. As a talent development intern in the Human Resource (HR) division of a major technology company, I was mainly responsible for assisting the competency development projects for the engineering teams in the company. Through these projects and others, I have had several interactions and discussions with engineers, engineering managers, and other human resource professionals. These discussions further reinforced the need for a better understanding of the engineer to manager transition process. More specifically, 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 (HR) managers who were responsible for training engineering managers. 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.

Upon reflecting on the internship experiences, I realized there were several issues facing the engineer to manager transition in companies that need to be investigated further. For example, companies across the globe are finding it difficult to identify and develop engineers into managers. Moreover, engineers also often find such a transition difficult. While the difficulty in transition remains unquestioned, there is a lack of understanding of how and what companies can do to

improve the engineering managerial pipeline. For example, what training and/or onboarding programs could companies offer to better the engineer to manager transition process? Or what kind of engineers would be good managers or leaders?

Around the same time, on the personal front, I was having several conversations with my partner, who happened to be an engineer aspiring to advance into a managerial role. He often talked about how he wanted to become a manager but had no idea on how to get there, including how to convince his supervisor of his managerial capabilities while being an individual contributor, thus enabling his potential promotion. I was also frustrated to hear that his supervisors promoted engineers to managers based on their gut feeling rather than through a more systemic approach based on performance, competencies, and/or credentials. Through these discussions, I realized that there was also a lack of common understanding of the nature of engineering managerial practice as well as the competencies that are often required for the transition among both engineering professionals and HR professionals in organizations. Through this study, I want to help engineers like my partner by providing them with examples and stories of engineers who have made the transition. I want to describe and detail the journeys of people who have recently transitioned into management roles and identify patterns related to those transitions so that engineering professionals, recent graduates, and HR professionals in organizations are more aware of the realities of such transitions and the lived experiences of the managerial role.

Both these professional and personal motivational factors solidified my interest in the topic. However, I also acknowledge that these experiences could bias my assumptions and interpretations during the study. To help recognize and manage my biases, I documented and journaled my journey as I went through every stage of this research study. I also adopted several other strategies throughout the research process to keep my biases in check. For example, during the data collection process, I made sure to allow my participants to tell their transition stories in their own voices and not interject their responses based on my prior knowledge and perspectives of an HR professional. Similarly, during analysis, I also explicitly journaled and bracketed my thoughts on what I know about the internal organizational policies, the leadership development programs, how the senior leaders perceived the newly transitioned managers based on my interactions with HR and senior leaders of the participating company to ensure I was judgment-free of my participants' experiences despite my insider knowledge of the company. I also noted down reflections on what I found interesting from my participants' experiences and how they related to my partner's experiences to

ensure I was aware of my biases when analyzing the data. I also made sure to find support from literature than rely on anecdotal evidence from my partner and prior experiences while collecting and analyzing the data. Overall, by acknowledging and addressing some of these biases, I hope to provide a more authentic account of the participants' transition experiences.

1.2 Background

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 (Lyons, Anselmo, & Kuller, 1993). 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 (Wearne, 2004). 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 engineering managerial roles involve balancing many more responsibilities, tasks, and priorities as compared to more traditional technical roles (Howard, 2003). This typically includes leading teams, delegating work, and managing resources, among other things (Howard, 2003). 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 (Lyons et al., 1993). For instance, in highlighting the challenges faced by engineers transitioning into managerial roles, Howard (2003) 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 (Farr & Brazil, 2012). Farr and Brazil (2012) also assert that companies and industry affiliates share similar thoughts on engineering professionals lacking leadership skills. My own experiences in the industry add further weight to such claims, including my interactions and informal interviews with engineering managers as a part of my recent internship experience, as described in the Preface. 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 cited here.

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 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 emphasis on the social or socio-technical aspects of engineering. These social aspects include building and maintaining relationships, communication, coordination, etc.- all of which are central to the current day engineering practice (Trevelyan, 2009). While revised ABET accreditation requirements continue to challenge the engineering education system to work towards producing engineers with broader professional skills (ABET, 2016), there is still very little research on engineering managerial practice, including the challenges that engineering managerial professionals face in their job roles.

This study addresses 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. Consequently, the following research objectives and questions are used to inform the study.

1.3 Research Questions

The main objective for this research study is to uncover the experiences of recently transitioned engineering managers, including to inform related educational programs and other supporting interventions. Specifically, the following research questions guide the research study:

Primary Research Question:

Research Question 1 (RQ1): How do engineers experience work-role transition as they advance into engineering managerial roles?

Secondary Research Questions:

Research Question 2 (RQ2): What type of personal changes do engineers experience as they transition into engineering managerial roles?

Research Question 3 (RQ3): What new skills do engineers perceive as critical for their survival and success in their new roles?

Research Question 4 (RQ4): What challenges or difficulties do engineers face as they transition into managerial roles?

1.4 Study Overview and Scope

To address the research questions presented above, a qualitative study is employed. Mainly, an interpretive qualitative mode of inquiry is used to address the research objective and questions. In accordance with the methodology, in-depth semi-structured interviews were conducted with 16 engineers who have recently experienced the transition to managerial roles. Each interview lasted about 60-90 minutes.

However, given the breadth of the research questions and the objective, the scope of the study is narrowed to explore the experiences of engineering managers working in a single organization. Prior studies by Wallace (2012) etc., have also adopted this single organization case approach for studying the engineer to manager transition. This narrowed approach could provide rich insights into the transition experiences for a specific context. Particularly, a single organization, Tel Corporation [a large mid-western telecom company], is chosen for the study. A company such as Tel that hires engineers as well as promotes engineers to engineering managers is well suited for the study. By maintaining the organizational context consistent, the variations in external factors related to cultural and organizational factors may be reduced. For instance, in this case, the organizational policies around the career pathways available for engineers remain consistent for all the participants. Mainly, Tel provides a dual career pathway for all its engineers and technical professionals. Engineers can choose to either avail the technical pathway (and remain as individual contributors) or switch laterally to move into management (manage and lead people and projects) after reaching a certain level in the technical path. Table 1.1 provides a general overview of the pathways available for engineers at Tel corp.

Table 3.1. Overview of career pathways and associated job titles for engineers at Tel Corp.

Title for Individual Contributors (Technical Path)	Title for Managers (Management Path)
Not Applicable	Director
Engineer Level 4	Manager
Engineer Level 3	Supervisor (not applicable for all functions/departments)
Engineer Level 2	
Engineer Level 1	

As we see, level three and level four job titles in the technical pathway are equivalent to the supervisor and managerial titles in the managerial pathway. In other words, a person moving from level 4 technical path to managerial role is only making a lateral switch as the two roles are ideally in the same job scale. However, it is interesting to note that engineers do not have much scope to grow beyond level four in the technical pathway. This is in contrast with the management pathway where employees do have a possibility to grow further into the Director role. There may be variations in how these policies are set up across different companies. Hence, a single case approach is best suited to keep these variations in check.

1.5 Limitations

In addition to the limitations associated with the scoping of the study, there are some other notable limitations associated with the focus of the study. First, the study focuses on engineers who have transitioned to managerial roles from individual contributor roles. Generally, individual contributor to manager transition is a critical and dominant pathway in the industry setting as beginner engineers are usually hired into individual contributor positions for at least some time before they are moved into managerial roles. But, there are other pathways through which engineers become managers. It is not uncommon for engineers to become managers without having a typical individual contributor role experience. For example, some engineers may directly be hired as managers in their first job roles, and some may even move in and out of the engineering profession to become engineering managers. The samples of such individuals taking alternative pathways to get into engineering managerial positions are not considered for this study. This consideration is in line with the purpose of the study: to mainly explore the experiences of engineers who have transitioned from individual contributor roles to managerial roles. Hence, the requirement of engineers working in an individual contributor role prior to the transition is essential to the study. Additionally, by limiting the scope of the study to explore experiences of engineers moving into managerial roles with a typical contributor to manager transition pathway, I hope to control for the variations associated with the other pathways.

Second, along with the different pathways, there are also different kinds of managerial roles and/or titles (i.e., people managers, product managers, project managers, technical managers, etc.) as potential career options for engineers moving up the management ladder. This study, however, does not delve into the specific distinctions of the various titles and kinds of managerial

positions. Specifically, sample participants are not excluded based on the type of managerial title, as long as they meet the sampling criteria, including being responsible for leading personnel and projects (see section 3.4.1), and their job roles meet the definitional criteria of engineering managers and/or manager; as noted in the definitions section, above. Additional limitations associated with the methodological choices are discussed further in Chapter 3.

1.6 Significance of the Study

By addressing the primary research question, the findings from this study describe and interpret the transition experiences of new engineering managers, which can, in turn, benefit four major stakeholders. First, the findings from the study are expected to inform engineering education researchers of the realities of engineering managerial practice and contribute to the growing body of research on engineering education and practice. Second, the study will likely be of interest to recent graduates and early career engineers looking to advance in their careers. The discussions on the lived experiences of recently transitioned managers might serve as a valuable guiding resource for future engineering managers. Third, the findings will benefit Human Resource (HR) and other industry leaders looking to understand better ways of developing engineering talent in companies. Fourth, the findings will benefit engineering educators and faculty of engineering leadership development programs by providing them insights about the nature of engineering managerial work practices, which can, in turn, inform better ways of preparing future engineering managers and leaders.

Additionally, by addressing the secondary research questions, the findings from this study are expected to help engineering educators, practicing 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 into managerial roles. Through these discussions on work practices, I additionally intend to bring awareness of the complex socio-technical nature of engineering practice. By placing a particular emphasis on the effective strategies employed by engineers to cope with the demands of new work roles, I 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 into

such roles, will contribute to the field of engineering practice and education by highlighting the reality of engineering managerial practices.

1.7 Definitions

Several terms are used in this study that have different connotations and meanings attached to them based on the context in which they are studied and/or referenced. These terms include manager, engineer, engineering manager, transition, and pathways. For consistency, it is important to understand how the terms were defined for this study. The following section provides context for the definitions and their associated meanings for the terms mentioned above.

Engineer

For the purpose of the study, the following definition of an engineer as synthesized by Davis (1996) will be used as a baseline:

An engineer is a person having at least one of the following qualifications: a) a college or university B.S. (and/or B.S.E) from an accredited engineering program or an advanced degree from such a program; b) membership in a recognized engineering society at a professional level; c) registration or licensure as an engineer by a government agency; or d) current or recent employment in a job classification requiring engineering work at a professional level (p. 97).

Based on this definition, I recruited participants if they met at least the *criteria a* specifically. That is, to be considered an engineer, the participant must possess relevant engineering and/or engineering technology degree from an accredited college. As the term engineer is often associated with a person who has acquired the required engineering competency by virtue of his or her training and/or education, a university degree from an accredited engineering program is considered a base requirement for the participants in this study to be considered engineers (i.e., criteria a). Moreover, in most organizations, a technical degree is often mandated and/or considered a requirement to be hired into an engineering position. Hence, a technical degree is considered a requirement for participants to be considered engineers for this study (refer to the Participant Selection section for more details).

Manager

Expanding on the ideas presented by Bartlett & Ghoshal (1992), Badawy (1995) synthesizes the definition of the term manager as “a person working for an organization who practices management, makes decisions, solves problems, and is responsible for the work of at least one individual reporting to him” (p. 6). He further characterizes three major criteria for a person to be qualified as a manager, which include:

1. A manager must practice management by performing a sequence of coordinated activities: planning, organizing, directing, and controlling.
2. A manager must get involved with managerial problem solving and decision making. Decision situations are choice situations with several available options. It is the manager’s responsibility, then, to evaluate the different options and make a choice.
3. The manager must have at least one individual reporting to him or her (this includes a secretary) because managing implies managing someone. Managers, thus, must guide, coach, and direct others (p. 6).

These criteria were used to define sample criteria for selecting the participants for the study (see Participant Selection section).

Engineering Manager

For this study, I will be considering engineering management as a specialized form of management. Consequently, the following definition of an engineering manager described by Bettine (2010) is used as the basis for the study. He describes an engineering manager as:

A person who leads technical professionals working in the fields of engineering, computer science, manufacturing, product development, technology, physics, or any other technical field involving personnel performing technical activities. Similarly, the profession of engineering management is a specialized form of management that is required to usefully lead engineering personnel and technical projects (p. 11).

This view of the engineering manager as a specialized form of a manager is critical to the study and is used mainly for developing the sampling criteria. Specifically, managers who are also qualified as engineering managers are recruited as sample participants for the study (refer to section 3.4.1). However, manager and engineering manager are used interchangeably in the study to describe the participants.

Transition

For this study, the term transition is loosely used as shorthand for the term career transition. A career transition is primarily defined as “a 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)” (Louis, 1980, p. 330). More specifically, transition in this study refers to the former kind, that is, a shift in job roles such as from an individual contributor role to an engineering managerial role. It is also interesting to note that, in a previous seminal work in this space, Howard (2003) assumed the optimal transition period as lasting for approximately two years for an engineer to transition fully into a managerial role. Expanding on this assumption, in this study, I have recruited participants who have transitioned to their new roles with the past three years. Correspondingly, terms such as early career/new engineering managers and/or recently transitioned engineering managers imply engineering managers that have been in their job roles for three years or less.

Overall, these definitions provide the background and context for the study. More specifically, these definitions were used as guidelines for framing and developing the sample criteria for data collection, as further discussed in Chapter 3.

1.8 Summary

In the following chapters, I will present the literature review relevant to the study. This will be followed by Chapter 3, in which I will further discuss my rationale and participant selection criteria along with aspects of methodological assumptions guiding the study. I will then present my findings in Chapter 4. The findings will include narratives of the participants as well as thematic findings from the data relevant to my research objectives. In Chapter 5, I will conclude with discussions of my findings in relation to the existing literature and research as well highlight potential implications for various stakeholders, including engineering educators and researchers, engineering professionals, and HR professionals developing engineering managerial talent within organizations. Appendix A consists of my interview protocol. Appendix B and C include recruitment email drafts sent to the participants by the HR manager of Tel corporation. Appendix D includes the demographic survey draft that was sent out to participants prior to the interviews. Appendix E contains the consent form that was shared with the participants prior to the interviews.

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2. LITERATURE REVIEW³

The objective of this chapter is to examine prior scholarship on career transitions with an emphasis on engineer to manager transitions. Particularly, I begin this chapter by providing an overview of prior work on career transitions. Given the focus of this study to investigate career transitions from the perspective of the individuals, related work-role transition frameworks and theories are discussed as well. Further, to the end of exploring the phenomenon of engineer to manager transition, in particular, I will also provide an overview of prior scholarship addressing the topic. After detailing relevant prior scholarship on career transition, work-role transition frameworks, and engineer to manager transition, I will present some of the gaps identified in this area of scholarship related to engineer to manager transition, gaps that would further inform the research questions for this study.

2.1 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)” (Louis, 1980, p. 330). More recent definitions have broadened the definition further by framing career transition as a process of engagement and disengagement from one work situation to another (Fernandez, Fouquereau, & Heppner, 2008). Not surprisingly, such broad definitions on the topic have led researchers to focus on and cover a wide range of topics under the larger umbrella of career transition (Fernandez et al., 2008; Peake & McDowall, 2012). However, for this study, career transition will be viewed as the transition from an individual contributor role to a managerial role within the same company. More specifically, the focus will be on the transition from an engineer or a technical contributor role to a managerial role within the technical division of a company. Further, since the study is focused on exploring the transition from the viewpoint of the individuals in transition, the engineer to manager transition is viewed

³ © IEEE. Portions of this chapter have been reused with permission (see Appendix F) Nittala, S., & Jesiek, B. K. (2018b). Work experiences of engineering managers: Challenges, strategies, competencies. *IEEE Frontiers in Education*. San Jose.

from a work-role theory perspective. In the following section (section 2.2.), I provide details on relevant work-role transition theories and frameworks.

2.2 Work-Role Transition Frameworks

Prior literature on work-role transition theories and frameworks is reviewed in the section. Essentially, principles from the work-role transition theories are used as guiding lens to explore the engineer to manager transition. Facets of work-role transition framework are well suited for this study as they help explore the transition from the perspective of individuals who experience it (Nittala & Jesiek, 2019). As noted by Anderson (2009), the literature on work-role transition is often concerned with aspects of entry, exit and the role transference that occurs in between these two phases of entry and exit.

Nicholson (1984) was one of the first scholars to propose a theoretical framework for work-role transitions focusing on the individuals' role in the transition process. He explored aspects of the individuals' adjustments to new roles during transitions. He asserts that individuals in transition make personal adjustments to meet the new role requirements or make changes to their new environment to meet their personal needs. These adjustment processes are characterized as personal development and role development, respectively. Further, role development and personal development strategies may involve changes in individuals' behaviors, skills, identity, formal and informal relationships, etc. In addition, Nicholson identifies four factors that could predict and influence the work-role transition for an individual. These include:

- (1) the requirements of the roles between which the person is moving, i.e., role requirements; (2) the psychological dispositions and motives of the person, i.e., motivational orientations; (3) the character of the person's past socialization into previous work roles, i.e., prior occupational socialization; and (4) the form of any current organizational induction or socialization practices that shape the person's adjustment to the new role, i.e., the induction-socialization process (p.172).

Mainly, he suggests that these factors can influence the range of adjustment modes, including replication, absorption, determination, and exploration. *Replication* concerns with transitions that call for very minimal adjustments on the part of the individuals. In transitions, a replication mode suggests that the individual functions in a similar manner as with their previous role. *Absorption* includes transitions “in which the burden of the adjustment is borne almost exclusively by the person, who does little to modify the parameters of the new role.” (p.176). *Determination* includes

cases where the role parameters are altered, but the individual remains unaffected. *Exploration* is related to transitions where changes occur in both the individual as well as the role parameters. He also describes the interactions among these factors with the role and personal development outcomes. However, the specificities of these interactions and relationships do not align with the focus of this study.

In his later work with West, Nicholson provided a more comprehensive framework to describe an individual's transition process (Nicholson & West, 1988). This framework represents the four distinct stages in which a work-role transition occurs for individuals. The first stage usually begins with the preparation for, or anticipation of, the new role and the transition. Next comes the encounter/reality shock phase, when the individual encounters surprises or shock due to the new realities associated with the role. The third phase is adjustment, wherein the individual deals with adjustment strategies concerning role development or work-role innovation and personal development to cope with the new role transition (Nicholson, 1984). Finally comes the stage of stabilization. In this stage, the individual feels more settled or stabilized in their new role. This phased work-role transition approach described here will be used as a guiding framework for investigating the transition process more holistically in this study.

Schlossberg's theory of work-role transition also views the transition from the perspective of the individual. Her theory supposes that transitions, particularly work-role transitions, are complex and time-consuming (Schlossberg, 2011). Some of this complexity may be explained by the transition-induced changes in individuals' behaviors, assumptions, relationships, attitudes, etc. Schlossberg, along with her colleagues, provides details of this framework in their book titled: *Counseling Adults in Transition, Fourth Edition: Linking Schlossberg's Theory With Practice in a Diverse World* (Anderson et al., 2012). Figure 2.1 provides an overview of this transition model. Mainly, the framework helps understand the kind of transitions individuals experience and how they cope with the changes associated with the transition. Schlossberg's framework consists of four factors to understand how individuals cope with the transition. These include 1) situation, 2) self, 3) supports, and 4) strategies. The *Situation* factor considers the aspects of an individual's personal situation as critical for understanding how well they cope with the transition. This may include aspects such as the motivation for the transition, the choice of the individual in the transition, other stresses in their personal situation, etc. *Self* refers to the person's physiological orientation and inner strength for coping with the transition process. The *Supports* factor considers

the availability of external support and resources as critical for the individual at the time of the transition. Having supports (or the lack thereof) may also impact the transition timeline for the individuals. Finally, the fourth factor encompasses the *Strategies* used by individuals to cope with the transition. For example, a person with many relevant strategies for coping with the changes may adapt to the transition more quickly than an individual who might not have many strategies in their repertoire. These four factors provide another guiding framework for understanding the internal and external factors that may impact the engineer to manager transition.

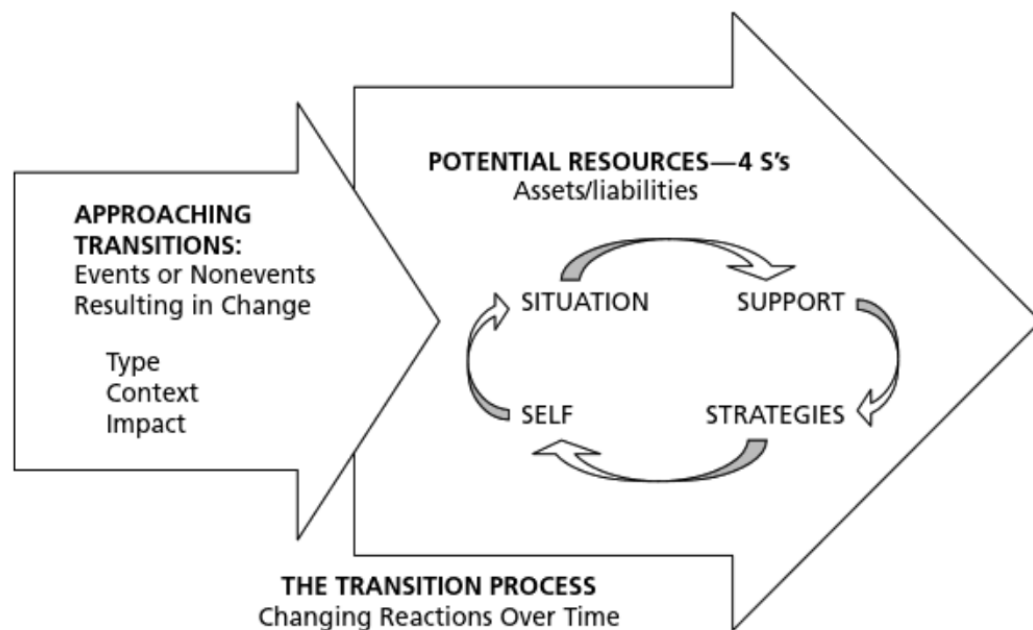


Figure 3.1. Schlossberg's Transition Process (Anderson et al., 2012, p.39).

Building on Nicholson's model, further studies in the field have also examined the various adjustments associated with the transition for individuals disengaging from old roles and engaging in new roles. In synthesizing the several aspects of changes or adjustments that are critical to work-role transition, Ashforth et al. (1995) suggest that "work-role transitions often entail a reorientation of goals, attitudes, identity, behavioral routines, informal networks and many other large and small changes" (p. 157). Not surprisingly, most literature on work-role transition addresses one or more of these aspects of the transition.

Particularly, as noted by Anderson (2009), authors have been approaching the studies on transitions and associated changes from two broad perspectives, namely the physiological aspects

and the relational aspects. However, he further argues for inclusion of a third perspective, namely the cognitive aspects in the study of transitions for a more holistic approach. Essentially, The psychological perspective deals with understanding how the transition alters an individuals' physiological constructs such as identity, persona, etc., as individuals transition into new work roles. Relational factors are often described as individuals' adjustments to social aspects, including inter-personal relationships, informal networks, etc., that are critical for the transition into a new role. While social and psychological dimensions are often central to most literature on work-role transition theories and models, Anderson (2009) also advocates for exploring the cognitive aspects such as thinking, memory, attention, etc., associated with the role transition to provide a more holistic understanding of transition.

While prior scholarly work on work-role transitions suggests that individuals experience several changes due to a role transition, there is limited literature exploring the various individual and personal changes that the individuals experience to adapt to the transition. Goebelbecker (2008), for one, investigated the different individual and personal changes associated with a work-role transition of senior leaders who moved from positions in the private sector to the nonprofit sector. The findings from his study indicate that individuals do experience a transformation as a result of the transition and experience several individual and personal changes. These include internal changes, changes in self-confidence, job motivation after the transition, self-identity, interactions with staff, job functions, and lifestyle, and other relational changes. In addition to investigating the change aspects of individuals in transition, his study also presented a framework to describe a more comprehensive participant schema of a transition. He suggests that "there is a flow to the transition experience beginning with the decision to enter the nonprofit sector, making the actual transition, and then the experience in the nonprofit." (p.172). And, the interactions among these different phases may impact the changes experienced by the individuals. While the findings from Goebelbecker's study are specific to the transition experiences of senior leaders from the private to the nonprofit sector, the categories of changes and the holistic transition schema identified in the study will be used as guiding frameworks to investigate the transition experiences of engineers moving into managerial roles, as well as the resulting individual and personal changes that they may experience.

Work-role transition theoretical frameworks have been generally used to study nuances of a wide range of role transitions such as a transition from expert clinician to novice academic

educator (e.g., Anderson, 2009), or a transition from middle manager to senior manager (e.g., Nicholson and West, 1988). These frameworks have rarely been used to study the transition process from an individual contributor role to managerial role. This study hopes to advance and inform the prior work on work-role transitions by exploring the transition experiences of engineers moving into managerial roles.

2.3 School to Work Transition of Engineers

The majority of work on career transitions for engineers and technical professionals has primarily been limited to school to work transitions. However, although not directly related to the topic of an engineer to manager transition, I am reviewing and including literature on school to work transitions due to its relevance and applicability to this study both in terms of findings and methods. Primarily, scholars have approached the school to work transition studies with an overarching objective to address the issues of difficulties faced by many engineers as they cope with the realities of the workplace. Mainly, these studies have sought to investigate the gap between engineering work practices and engineering education, gaps that make the transition from school to work difficult for engineers.

Owing to the complex nature of the transition phenomenon, scholars have investigated the topic of school-to-work transition through various lens. For instance, Korte (2007), in his dissertation, focused on addressing questions related to how engineers learned to socialize or onboard into their new roles. His work employed theoretical frameworks of social cognition and exchange to understand how new engineers learned the social norms of their new roles and integrated into their new roles. The qualitative findings from his single organization case study suggested that engineers learned the social norms through building good relationships with their workgroups and other colleagues. While Korte focused on new-comers' experiences of learning through social relationships, another author, Babajide centered her work around exploring the role of a company-provided training program, namely the rotational program, in helping engineers develop new skills and knowledge for their new roles (Babajide, 2020). The findings from her mixed-methods dissertation study reveal that engineers who participated in the rotational programs fared better than their counterparts who did not participate in the program in at least 5 of the 11 pre-determined learning outcomes ascribed for new engineers. However, consistent with Korte's findings, Babajide's findings also hint at the importance of relationship-building in the onboarding

process. Mainly, she suggests that engineers who participated in the rotational programs formed networks both within their program cohorts and across departments, which may have further contributed to their development in the early career stages.

Huff (2014), on the other hand, studied the topic from an identity perspective. His dissertation work focused on the psychological journeys of engineering students as they transitioned into the workplace. One of the major findings from his interpretative phenomenological analysis study was that as engineers transition into the work-place settings, they develop an enhanced perception of the complex socio-technical nature of engineering work. Similar sentiments on socio-technical complexity of engineering work are also echoed in the works of Brunhaver, Korte, Barley, & Sheppard (2018), who assert that as engineers transition into work-place settings, in addition to technical work, they are also often tasked with non-technical social or professional responsibilities “that require significant social interaction, such as managing projects and coordinating the work of other people”(p. 149-150). And, often, engineers feel ill-prepared to take upon such responsibilities. Further adding to the discussion, Jesiek et al. (upcoming) assert that, while navigating socio-technical complexity is evidently difficult for early-career engineers, it becomes more pronounced as they advance in their careers. In another line of work, Jesiek and colleagues also argue that as engineers’ transition from school to work, they are challenged to span several organizational boundaries such as inter and intra team, inter-organizational, vertical, and hierarchical boundaries. And, in order to effectively span these boundaries, early-career engineers are required to leverage and develop a wide variety of skills and competencies including but not limited to communication, coordination, information and knowledge management, representing and influencing (Jesiek et al., 2017). Their findings stem from a qualitative study that uses interview data of multiple early-career engineers. Along similar lines, Trevelyan (2007), through his multi-method study comprising of surveys and field observations of early-career engineers, also identifies and notes the importance of coordination and working with other people as an important competence for engineers to develop as they transition into the work-place setting. Overall, these studies elucidate the difficulty in school to work transition as well as provide commentary on the new skills and competencies that early-career engineers need to develop for the transition.

As noted by Brunhaver et al. (2018) and Trevelyan and Tilli (2008), most studies have traditionally relied on survey data to explore the school-to-work transition and work practices of

early-career engineers. In citing the limitation of adopting a sole survey technique to explore transition, Brunhaver et al. (2018) state that the survey data “allow participants to voice their perspectives within the scope of defined response options, but that give no opportunity for researchers to acquire a deeper contextually sensitive understanding of young engineers’ experiences at work” (p.132-133). However, more recent studies, as noted above, have been approaching the topic from a more qualitative and interpretive lens (Huff, 2014; Korte, 2007; Jesiek et al., 2017).

Further, to explore the transition process, most of these studies included sample participants who spent anywhere between 2 to 6 months and less than three years in their new roles (Brunhaver et al., 2018; Korte, 2007). Prior studies exploring career transitions for engineers suggest that individuals need an average of three years to transition into their new roles (Howard, 2003; Korte, 2007). This range provided input to my participant selection criteria for exploring the engineer to manager transition. Overall, the various aspects of the school to work transition attempted by scholars, aspects including and related to identity changes, competencies, socialization, challenges, and barriers, etc., have provided inputs to this study framing due to their relevance to engineers in transition at a variety of career stages. In addition, the various methodologies adopted by scholars investigating the school-to-work transition, including the interpretive qualitative techniques, have provided inspiration for this study.

2.4 Engineer to Manager Transition

While there exists several studies exploring different kinds of career and work-role transitions, studies focusing on engineer to manager transition remain scant (Nittala & Jesiek, 2019). Further, the few existing 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 (Hood, 1990), others have viewed it as a process (Hall, Munson, & Posner, 1992; Howard, 2003). Another source has even discussed it as a series of events or as a continuous process (Seethamraju & Agrawal, 1999).

While a small but 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, informal learning, and socialization (Bland, 1996; Wallace, 2016). For instance, Wallace (2016) emphasized the role of organizational socialization in an effective

transition for engineering managers. Other researchers such as Bland (1996) and Dittman (2009) explored the role of education in the transition. Furthermore, scholars such as Bayton and Chapman (1972) and Johnson and Sargeant (1998) explored the role of motivation and motivational models in transition. Yeh (2008) more specifically explored the experiences of “derailed managers” or managers that do not transition well, while Seethamraju and Agrawal (1999) investigated the various factors that influence and/or impact the engineer to manager transition process. They also provide a model depicting organizational, individual, and educational factors influencing the transition process, namely. Their findings also hint at gender differences in the transition process but do not provide any specific details. Further, they acknowledge having a small sample of female participants to provide any conclusive pieces of evidence.

As an added layer of complexity, the purpose of prior studies has also been vastly different. Whereas some authors adopt a competency approach to study the transition process (Hood, 1990; Thamhain, 1991), a few sources have focused on the emotional aspects of the transition (Liu, Englar-Carlson, & Minichiello, 2012; Wearne, 2004). In another line of research, authors have studied the transition from an organizational needs perspective through the human resource management lens (Biddle & Roberts, 1994; Roberts & Biddle, 1994).

Yet despite striking differences in purpose and perspectives used to study the transition process, the work in the engineer to manager transition domain has been mostly mainly limited to three main considerations, namely: 1) competency and skill need related to transition (Hood, 1990; Lyons et al., 1993; Thamhain, 1991); 2) challenges associated with the transition (Howard, 2003; Wilde, 2009); and 3) strategies or developmental aspects for an effective transition (Hall et al., 1992; Hood, 1990; Wallace, 2016). There remains a lack of literature offering more holistic descriptions of the experiences of recently transitioned managers, which could, in turn, uncover other aspects of the transition from the perspectives of the engineers themselves. In the following sections, I will delve into the specific literature on the three major aspects of an engineer to manager transition identified as above.

2.4.1 Skills, Competencies, and/or Attributes Essential for Engineers Transitioning into Managerial Roles

Several authors have investigated the nuances of career transition by evaluating the competency and skill demands at different levels, including pre-and post-transition. Indeed, such

an emphasis is vigorously promoted in the works of Charan, Drotter, & Noel (2011), as they identified the need to critically understand and evaluate skills, among other things, for an effective career transition. This is also true for scholarship focused on the engineer to manager transition, where several authors have been vocal in identifying the skills and competencies necessary for engineers transitioning into managerial roles. In fact, this focus is pronounced even in studies as early as the 1970s, works including that of Bayton and Chapman (1972).

However, much of the workaround competency identification for the transitional managerial role is heavily influenced by the management literature. Managerial skills or competencies related to administrative tasks or working with people have been viewed as foundational for many studies of the engineer to manager transition. One of the early contributors to the field, Hood (1990) also talks about the importance of the general managerial attributes as necessary for engineers for an effective transition to engineering managerial roles. He refers to the traditional managerial and leader competencies, including guiding, organizing, planning, staffing, communication, and dealing with people and problems as critical to the engineer to manager transition process. While these findings are critical to the current study, the validity of the findings is questionable due to the lack of robust methods and methodological evidence provided in the study. Although Hood references the use of personal experiences, surveys, and literature as primary sources of data, he does not detail any of the specific methods used in the study.

Thamhain (1991), on the other hand, offers what he calls global aptitudes necessary for engineers to develop for the transition phase, which includes personal desire, people skills, technical knowledge, administrative skills, and business acumen. Thahmain's findings come from numerous data points, including surveys, personal interviews, and questionnaires with over 800 sample participants. In a two-phase data collection process, Thahmain first collected data through questionnaires and personal interviews with over 450 sample participants. This data informed the development of the aptitudes listed above, which were further tested in the second phase through a 10-point Likert survey administered to samples that included 210 managers and 640 of their subordinates. Similar thoughts are also echoed in the editorial type works of Porbahaie (1994), as he talks about communication skills, leadership skills, interpersonal skills, and personal ability as being the necessary "qualifications to bridge over [these] transitional differences" (p.73) associated with the engineer to manager role transition.

Badawy (1995) expanded on this list further by proposing a more detailed set of managerial competencies ideally required for engineers in transition. In his work on developing manager skills in engineers and scientists, he lists what he calls “ingredients of managerial competency” (p. 28). These competencies are further divided into categories such as knowledge, skills, and attributes. Under attributes, he suggests the need for managers to have a strong will to manage, a strong need for power, and a substantial capacity for empathy. Further, he expands the skills list into two levels of subcategories, with the first level sub-category, including interpersonal, technical, and administrative skills. Next, in the second level subcategory, he goes on to emphasize the importance of interpersonal skills as he classifies them further into conflict management, handling power and corporate policies, coaching and appraising performance, communication, motivation, and leadership (Badawy, 1995, p.29). Although this provides a useful framework for further studies on competencies, the credibility of the findings comes into question, owing to the lack of empirical grounding for the work. Notably, there is no discussion on the nature of the scholarship in his work, barring the introduction section of the book, which discusses his personal experiences as data points for the account.

Along similar lines, other scholars have more recently created lists of competencies as deemed essential for engineers moving into managerial roles (Custovic & Insaurralde, 2016; Mahlangu & Govender, 2015). Like prior literature, the competency lists from the newer studies are also heavily influenced by the traditional management literature. According to Mahlangu & Govender (2015), competencies stemming from prior literature, including planning, organizing, supervising, and controlling, are still considered critical to the new role. They also list four other competencies as crucial for the engineers looking to transition into new roles, namely: “dealing with people, information-sharing, decision-making and problem-solving” (p.6). This list stems from a sequential mixed-methods study conducted by the authors with over 250 participants, including technicians, supervisors, and HR administrators from a single organization in South Africa.

More recently, in trend with leadership literature on other types of career transitions (Charan et al., 2011), work by Custovic & Insaurralde (2015) emphasizes specifically the leadership competencies required for the transition from an engineering role to a managerial role. This non-research paper published in IEEE Engineering Management Review lists specific leadership qualities as necessary for engineers during the transition, including respect,

communication skills, empowering people, trustworthiness, and leading by example. However, the authors do not provide much empirical evidence to support these claims.

While most of the studies discussed thus far have focused on identifying lists of general managerial or leadership competencies or attributes, one recent paper by Wallace (2016) discussed findings that were targeted for engineering managers more so than general managers. The author also emphasizes the new leadership competencies necessary for an engineering manager “to manage a diverse cultural team in order to achieve healthy team dynamics and achieve technical productivity” (p. 94). This work by Wallace (2016) is perhaps one of the first papers in this line of research that has catered to the specific aspects of managing cultural teams and the global aspects of management of the new transitional engineering manager role. The leadership and managerial competencies identified by Wallace (2016) include: 1) political, 2) communication, 3) time management, 4) diversity, 5) coaching skills, 6) conflict management, 7) negotiation, 8) planning and administration, 9) teamwork, 10) strategic decision making, 11) global awareness, 12) self-management and 13) technical skills. However, as the author acknowledges, this set of competencies deemed essential for transitional engineering managers may be limited to engineers in developing countries since the study focused on the South African context. Wallace’s findings come from data gathered for a qualitative study, data including semi-structured interviews of 16 engineers and technologists.

These literature sources are useful for this study as they provide a base framework for my secondary research question related to identifying competencies, skills, and/or attributes required for engineers in transitions. While these studies provide an intriguing list of desired competencies and attributes for recently transitioned engineering managers, further studies are needed to address the inconsistencies and uncertainties in the competencies listed, in part due to the lack of high-quality empirical research studies.

2.4.2 Challenges in engineer to manager transition

Several authors who have studied the engineer to manager transition process have also explored the challenges associated with the transition process. From early works by Hood (1990) and Badawy (1995) to more recent contemporary works of Howard (2003) and Wilde (2009), most of the literature hints at one or more challenging aspects of the engineer to manager transition. However, there exist some inconsistencies in the challenges identified by prior authors in this field

of work. Except for a few commonly identified challenges, such as related to communication, delegation, and supervision, most of the work in this space remains inconsistent with respect to the findings. There is a lack of consensus regarding the main challenges as identified in the prior literature.

Not surprisingly, even in the earlier works by Hood (1990) and Badawy (1995), the inconsistencies are evident. Whereas Hood (1990), through his survey, identified the delegation of work, ability to “communicate skillfully” and the issues in “directing and guiding the efforts of others” as top listed challenges for engineering managers (p. 26). Badawy (1995) identified several challenge areas associated with the engineer to manager transition that does not necessarily align with Hood’s findings. Some of the challenges identified by Badawy (1995) include:

1. Technical supervision
2. Budgeting time and effort
3. Communication
4. Personnel
5. Excessive diversion of R&D and engineering effort
6. Keeping current in fields supervised (Badawy, 1995, p.26)

As noted earlier, despite similarities in primary challenges related to communication, supervision, and delegation of work, Badawy’s list deviates from Hood’s list, as he emphasizes the difficulties in maintaining current knowledge in the supervisory fields along with the difficulties in managing R&D (Research and Development) and engineering efforts. These inconsistencies might have stemmed from the variations in methodologies adopted by the scholars to arrive at the findings. Further, the nature of the participant pools and/or the study settings could have also contributed to the inconsistencies.

Following this earlier line of research, more recent works have likewise cited challenges related to delegation of work, ability to communicate, and managing resources (Howard, 2003; Wilde, 2009). However, these recent scholars have provided a better and more nuanced understanding of transition challenges as they shift significantly from older works in terms of their approaches and rigor (Howard, 2003; Wilde, 2009).

Notably, Howard’s (2003) study on investigating the challenges of transitioning can be considered a pivotal work from a research perspective. It was one of the first studies to investigate the challenging aspects of transition through a more rigorous methodology based on

phenomenology. Through his work, Howard (2003) provides a list of challenges experienced by three of his sample participants during the transition. The sample included engineers transitioning to managerial roles at aerospace companies in New York. The challenges include:

1. So much going on: The engineering manager role involves balancing many more responsibilities, tasks, and priorities than the engineering role.
2. Relationship changes: Personal relationships, interaction dynamics and engineer perceptions of you have changed.
3. Delegation: The challenge of leaving the hands-on technical behind and learning to work through others.
4. Increased stress and pressure associated with increased responsibility.
5. Developing new skills: Discovered the need for a new set of skills as a manager.
6. Resources and getting the work done: Finding the time, the staff and other resources to get it done.
7. The new guy in management: Change from being a technical expert to being new in management and having a lot to learn.
8. Organizational issues: In a new organizational level with its associated issues.
9. Choosing the management career path: The concerns before deciding, and questions experienced during or after, the transition (Howard, 2003, p. 208)

While some of these challenges overlap with the earlier findings of Hood (1990) and Badawy (1995), Howard claims to have deviated significantly from prior works. In referring to the differences, he asserts that both Badawy (1995) and Hood (1990) dealt with task-oriented challenges, whereas his list inclines more toward “individual personally found challenges” (p.235). Support for Howard’s (2003) list was later confirmed by Wilde (2009) through a quantitative study. Wilde’s study included survey responses from 220 engineering managers, all employed by the same company. In addition to establishing the generalizability of some of the challenges described by Howard (2003) across a larger population, Wilde (2009) also describes other factors such as the type of engineering degree earned, graduation year, etc., that seem to influence the challenges faced by transitioning engineers. For example, he notes that engineers who graduated after 2000 felt more prepared for the transition as compared to those who did before 1996. However, on the contrary, these students who graduated after 2000 also “faced greater difficulty with being the new guy in the ranks of management.” (p.76). As one of the seminal works in this space with high-

quality rigor and methodological discussions, Howard's work is also considered important for this study. Notably, the list of challenges identified by Howard offers potential insights for addressing the secondary research question that caters to identifying challenges in the engineer to manager transition. While Howard's (2003) study focuses on exploring the experiences and challenges of engineers in Aerospace companies in New York, this study will be situated in another context, namely a single telecom organization.

Taking a different approach, a study by Hodgson, Paton & Cicmil (2011) revolves around the transition of engineers to project managers, and the challenges associated with such a transition. Not surprisingly, these challenges were largely specific to project management and do not resonate well with any of the findings from the previous literature on the engineer to manager transition. Notably, the authors argue that engineers often perceive the project management role to be more attractive and influential. Yet, the reality of the role for those experiencing it is rather unexciting with limited influence. Not surprisingly, these gaps often create "tensions" in the transition process. Moreover, these gaps are intensified as new project managers "relinquish their position as technical specialist, and renegotiating relationships with former colleagues." (p. 380)

Overall, these findings suggest that despite some consistency across literature in a few of the identified challenge areas, including delegation, communication, and supervision, many of the challenges identified in recent studies have been unique to their respective studies. Additionally, barring a few noted studies, there is little emphasis beyond the challenges experienced by the engineers in transition to also explore how they experience and navigate some of these challenges.

2.4.3 Strategies for an effective engineer to manager transition

Strategies associated with effective role transitions represent another prominent topic in several works on the engineer to manager transition (Hall et al., 1992; Hood, 1990; Wallace, 2016). Usually, strategies and/or suggestive actions for the concerned stakeholders involved in the engineer to manager transition process are at the core of the transition discussions. The three major stakeholder groups often include the individuals in transition, the organizations preparing individuals for the transition, and universities involved with developing engineering managers. For instance, Hood (1990) lists essential steps or actions required for an effective transition targeting both the individuals and the organizational training groups in a section that he termed "preparation for transition." These suggestive actions based on findings from his survey include:

1. Being given assignments that will develop management skills,
2. Being a lead person,
3. Being given assignments that will clarify management roles and responsibilities,
4. Acquiring formal management education, and
5. Accumulating significant years of technical experience (Hood, 1990, p. 27).

Extending the line of research further, Hall et al. (1992) discussed strategies for not only employees in transition but also for other stakeholders in the process, including the universities preparing students for managerial transitions and employing organizations. Moreover, this paper also stands out as one of the primary works from around the 1990s that offered strategies or actions for the parties involved in the transition that was entirely based on empirical research. The data for the study comes from survey responses of 132 participants who were at the time working full-time and enrolled in an MBA program at Santa Clara University. The survey included both Likert scaled response categories as well as open-ended questions. Additionally, the research work was grounded in a social exchange theory, adding further weight to the findings. The authors examined the role of specific actors in transition, including the engineer-student, employer-organization, and the university-college offering formal management training. The authors not only describe the tensions that exist within each of these relations but also propose actions to be initiated by each party to ease the transition process. Consequently, the authors offer two suggestive actions for the engineer-student in transition:

They [Engineer-student] should meet with university career counselors to discuss career paths and ask for feedback regarding the career paths taken by university alumni. They should request dialogue with their organization's human resource personnel, and with their supervisor, regarding the role that continuing education might play in their career path (p. 301).

Furthermore, to avoid further tensions in the transition process, the authors suggest that employers need to be supportive of engineers pursuing MBA degrees. Additionally, the authors offer suggestions/strategies for universities to help ease with the transition process for engineers, stating: "Universities may need to act as a catalyst to facilitate greater dialogue and reduce the expectation gaps between employers and engineers" (p. 301)

While the early authors such as Hall et al. (1992) and Hood (1990) grounded their findings using empirical approaches, several other papers from around the early 1990s presented strategies for effective transition but were not based on empirical research. Most of these works seem to have

relied on anecdotal and personal evidence. Yet, it is still noteworthy to explore some of the ideas surrounding the topic from these non-research papers, as these suggestions and references have been used as guiding points to develop further studies in contemporary literature. One such paper is from DelMar (1990), who provides readers with an exhaustive set of suggestions for effective transition, including 1) recognizing responsibilities, 2) distancing from prior responsibilities, 3) developing a new management perspective, 4) recognizing roles and responsibilities of managers, 5) achieving social distance, 6) motivating subordinates, 7) developing a managerial style, and 8) recognizing subordinates' commitment. Some of these strategies were similarly voiced in another opinion work by Rimler (1991), as the author emphasized strategies focused on accepting new job roles, acknowledging changing patterns of social relationships, and other recommendations. Although not necessarily in line with the kind of strategies discussed, following the tradition of his contemporaries, Porbahaie (1994) offers some suggestions for engineers looking to transition. In his essay, the author states that engineers looking to transition “should consider education to be a life-long process, learn managerial techniques from competent mentors, get involved in a broad array of professional activities and, finally, learn the organizational culture and expand their political awareness” (p. 74).

As further evidence of growing inconsistencies in the lists of strategies identified by the authors, Badawy (1995) adds yet another set of details to the strategies aspect of transition by catering to the needs of several other stakeholders involved in the process, including the individuals in transition and the management team. Specifically, for the management team, he presents detailed plans for effective management of transition by providing recommendations for identifying managerial talent and selecting the best engineers. These strategies and/or plans include rewarding the transitioning managers, providing better opportunities for engineers in transition, etc. Similarly, for individuals in transition, he emphasizes the need for them to manage their career planning carefully, among other things. Although Badawy's work seems to provide a useful framework for further studies on strategies, it is important to note that the work is not grounded in an empirical research approach.

Unlike the strategies offered by authors in the early works, more recent work by Wallace (2016) highlights effective strategies for transition based on a phenomenological study. Through thematic analysis of interview data collected from 16 engineers in a South African company, the author identified several challenges and relevant strategies that help with the engineer to the

manager transition process. Mainly, the author looks at the role of organizations in enhancing the transition process and suggesting strategies for organizations to transition their engineers to engineering management roles effectively. Particularly, the role of coaching in enhancing the transition experience for engineers is discussed in the study. Wallace (2016) also suggests that senior managers should act as coaching guides for new engineering managers to ease the transition process. Although Wallace provides a comprehensive list of challenges, competencies, and strategies for an effective engineer to manager transition, the findings are limited to a single organization in a South African context where the study was situated. The findings from this study are nonetheless very relevant to my secondary research questions.

2.5 Gaps in the Literature

Although a growing body of literature has explored various aspects related to the engineer to manager transition, the quality of the previous papers is a concern, as many studies in the literature reviewed above lack a firm methodological or theoretical grounding. In fact, some of the literature sources are more like opinion pieces or editorial essays rather than complete empirical works, e.g., Custovic & Insaurralde (2016). However, due to the scarcity of the literature, some of these very sources have been used as guiding points in contemporary works in this area of study. For instance, Howard (2003) dedicated one section of his literature review to two such articles – namely Badawy (1995) and Medcof (1985) – in what he termed as ‘non-research papers,’ which have also shaped his study in some respects. Such desperation to seek sources that do not ‘qualify’ as proper research signifies a visible lack of empirically-based research work in the space.

Moreover, some of the primary research work in the transition space is potentially outdated. Despite the fast-changing nature of engineering management practice (Bowman & Farr, 2000; Shaw, 2002), most of the recent studies on the engineer to manager transition have continued to base their work on increasingly outdated literature, thereby exposing vulnerabilities of the relevance of their studies in relation to changing experiences, challenges, and attributes of new engineering managers.

Another major drawback in this line of research is the lack of clarity and understanding regarding the roles and responsibilities of engineering managers, which has a direct influence on the experiences, competencies, challenges, and strategies identified as necessary for a transition into such roles. Beyond a mere emphasis on engineering managers as subjects of the study, most

of the studies, thus far, have failed to describe who qualify as managers or engineering managers. Further, some studies have fallen into the trap of not making a clear distinction between a general manager and an engineering manager. Most studies have also failed to take into account the socio-technical nature of the engineering management role. For example, Shaw (2002) argues that engineering management should focus on integrating both technical and managerial aspects. He suggests doing that by redefining engineering management as a function of three major skillsets, including product development, project management, and systems engineering. By focusing only on the typical managerial and social components of the role, the authors fail to acknowledge the intertwined socio-technical nature of the engineering managerial role.

Additionally, it may be valuable to note that most studies, barring a few exceptions such as Howard (2003) and Wallace (2016), have not approached the engineer to manager transition through a more interpretive worldview. Further, even among those few studies that have taken a more interpretive approach, there is a lack of focus and emphasis on exploring participants' perspectives and lived experiences of the transition journeys. For instance, Howard (2002) focuses mainly on the challenges aspect of the transition, and Wallace (2012) focuses on aspects of competencies, strategies, and challenges associated with the engineer to engineering manager transition. While these are essential to the current study, I would also like to extend on these prior concerns by more holistically exploring the experiences and meaning-making of engineers as they transition into engineering managerial roles. Furthermore, the literature review suggests the lack of rich descriptions of participants' experiences and their work activities. Contemporary research in engineering education suggests that such rich descriptions of experiences and activities are often valuable to understand the broader setting. For instance, engineering practice studies, focusing on the school to professional work transition, call for the need to gather rich descriptions of workplace practices and experiences, including to better illustrate the underlying constructs of transition such as challenges and competencies (Jesiek, Zhu, Ramane, & Choudhary, 2015; Walther & Radcliffe, 2007).

As these gaps in the literature suggest, research on the engineer to manager career transition remains significantly unexplored, despite claims of its importance to the individuals as well as organizations at large. Furthermore, there are many missed opportunities and uncharted research questions related to the transition from engineer to manager that have been central to other focus areas of career transition studies in other fields, such as by leveraging a work-role transition

framework in examining the transition process. To address some of these gaps, I aim to explore the lived experiences of engineers that have transitioned to managerial roles. Through these experiences, I also aim to uncover underlying commonly studied aspects of transition, such as changes, challenges, skills, and strategies for dealing with the transition. Consequently, the following research questions are used to guide this study:

Primary Research Question:

Research Question 1 (RQ1): How do engineers experience work-role transition as they advance into engineering managerial roles?

Secondary Research Questions:

Research Question 2 (RQ2): What type of personal changes do engineers experience as they transition into engineering managerial roles?

Research Question 3 (RQ3): What new skills do engineers perceive as critical for their survival and success in their new roles?

Research Question 4 (RQ4): What challenges or difficulties do engineers face as they transition into managerial roles?

Mainly, I will examine the engineer to manager transition process from the perspectives of the individuals through an interpretive lens. I will explore the engineer to manager transition process through work-role theory models and frameworks that were largely adopted in other fields to investigate transitions of varied kinds. Through these frameworks, I will also seek to present a framework to describe the transition process for the participants in the study. Chapter 3 details the specific approaches and methods used to analyze and present the findings.

Although I focused my literature review on work-role transitions, I also want to acknowledge that there are other frameworks and theoretical lenses that may have a bearing on the engineer to manager transition. The study of organizational and work-group culture is one such lens. Primarily, authors studying culture have argued that each profession, including engineering, could have a distinctive culture developed through a shared history. More generally, members of a group form a set of values and/or behaviors through a shared history of experiences. These expected values and behaviors lend themselves to forming shared assumptions for defining a group culture (Schein, 1990). Further, Pilotte (2013), in synthesizing the literature on engineering culture, identifies several salient features that define engineering culture more broadly, features such as a)

focusing on technology and its uses, b) prioritizing abstract technical knowledge over human interactions, c) solving societal problems using technical skills, etc. Through their education and socialization into workplaces, engineers learn and carry with them some of these deep-rooted assumptions and shared values. However, things change if and when engineers are required to move into management as management comes with its own distinct culture with a separate set of shared values and assumptions. Consequently, it can be argued that as engineers move into managerial roles, they are often required to learn and imbibe new cultural norms of the managerial world, making the transition process difficult. For instance, contrary to the engineering mindset of sole technical problem solving, as managers, they are required to problem solve by leading and managing people. Likewise, they are also required to learn other social norms and values pertaining to the managerial culture. Similar thoughts are also echoed by scholars studying engineering entrepreneurship. For instance, Duval-Couetil, Ladisch, and Yi (2020) assert that engineers seeking to move into entrepreneurship are often required to learn a new language and orient themselves to a new culture of entrepreneurship that is quite distinct from engineering. Hence, it can be further suggested that engineers moving into managerial roles may undergo cultural shifts and may need to learn the new language of management culture. These cultural shifts further impact how individuals transition into a new role.

Boundary spanning framework is another complementary line of research that could have relevance to the engineer to manager transition. As noted by Jesiek, Mazzurco, Buswell, and Thompson (2018), early-career engineers are often required to span several boundaries and engage in boundary activities in their new professional roles, activities including but not limited to a) coordination, b) information and knowledge management, c) building and maintaining networks, and d) representing and influencing. And, as engineers move up the career ladders, they see a shift in the prevalence and the kinds of boundary activities that they engage in. More specifically, as engineers advance in their careers, there is an evident increase in “informal leadership” boundary activities mandating them to acquire new boundary spanning competencies related to managing and leading people (Jesiek, Buswell, & Nittala, upcoming). It can also be argued that when engineers become managers, it reconfigures what boundaries they need span. For example, as individual contributors, they need to span upward hierarchical boundaries for interacting with their managers. As managers, they not only have to span upward hierarchical boundaries with their new supervisors but also get work done through the engineers reporting to them and thereby needing a

top-down view of work. Even more generally, boundary spanning competencies such as are of particular relevance to the study in looking at the specific competencies and skills required for engineers and how those change as they become managers. While aspects of culture and boundary spanning will be used in the data analysis process, investigating the transition exclusively through the lens of culture and/or boundary spanning is beyond the scope of this work.

3. METHODS⁴

The purpose of this research is to investigate and understand the meaning-making and lived experiences of engineers who have transitioned to engineering managerial roles. In this chapter, I detail the specific research methods used to address the research objective. First, I will provide a brief overview of the research methods along with details of the research questions used in the study. Next, I will delve into the specific aspects of the methods and provide descriptions and justifications of the research paradigm and methodology adopted for the study. I will then discuss the aspects of data collection and analysis and will conclude with discussions on the validity and reliability of the study design.

3.1 Research Questions and Overview of the Methods

To explore the holistic lived experiences of recently transitioned engineering managers, a set of primary and secondary research questions are used to guide the study design. Mainly, to describe the transition journeys of engineers as they move into engineering managerial roles, the following primary research question is explored:

Research Question 1 (RQ1): How do engineers experience work-role transition as they move into engineering managerial roles?

In addition to exploring the holistic experiences of transition, the study also aims to uncover the specific changes, skills, and difficulties experienced by the engineers during the transition. To the end of identifying common themes associated with the above-mentioned aspects of transition, the following additional secondary research questions are also explored.

RQ2: What personal changes do engineers experience as they transition into engineering managerial roles

RQ3: What new skills do engineers perceive as critical for their survival and success in their new roles?

⁴ © IEEE. Portions of this chapter have been reused with permission (see Appendix F) Nittala, S., & Jesiek, B. K. (2018b). Work experiences of engineering managers: Challenges, strategies, competencies. *IEEE Frontiers in Education*. San Jose.

RQ4: What challenges or difficulties do engineers face as they transition into managerial roles?

The following figure (Figure 3.1) provides an overview of the specific methodology and methods employed to address the above research questions. In the later sections, I provide further details describing the methodologies and specific methods used in the study design.

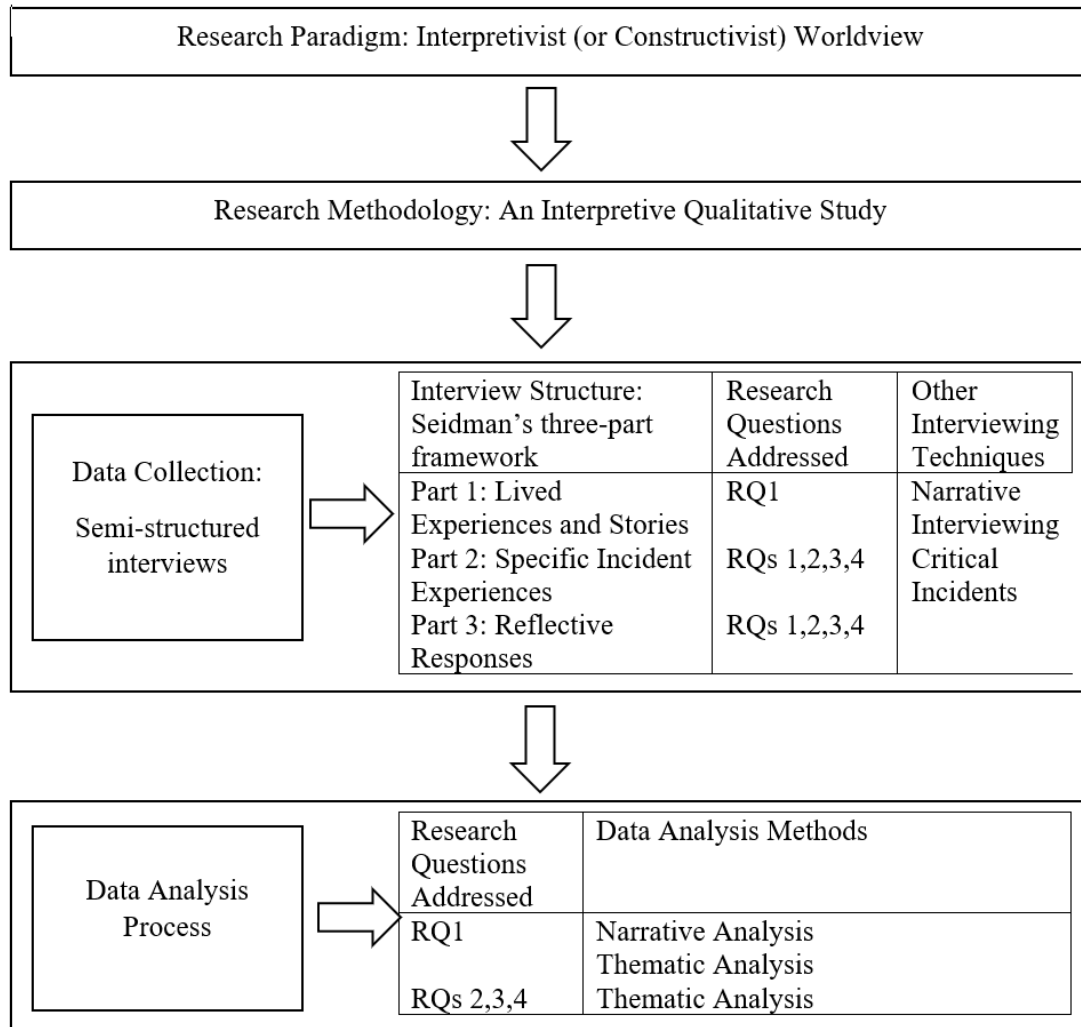


Figure 3.1. Study Design Overview.

3.2 Research Paradigm

I align myself with an interpretivist (or social constructivist) research paradigm. As a researcher with an interpretivist worldview, I hold the assumption that reality is constructed by individuals. I also presuppose that there exist multiple realities as constructed by individuals rather

than a single objective truth (Creswell, 2009, Chapter 1; Ponterotto, 2005). Typical to a constructivist-interpretivist research approach, I am concerned with the ‘lived experiences’ of engineers as they transitioned to engineering managerial roles. In adhering to the tenets of the interpretivist worldview, I have acknowledged my own stance and positionality that have a bearing in my interpretations of how people make sense of their experiences. This acknowledgment is reflected throughout the study design. More specifically, I explicitly provide details about my role as a researcher, positionality, motivation for the study, and relevant past experiences in the Introduction chapter (see section 1.1). In line with this worldview, an interpretive qualitative methodology is used to explore engineers’ experiences of transition to engineering managers.

3.3 Research Methodology: Basic Interpretive Qualitative Study

In accordance with the philosophy of a constructivist-interpretivist worldview, a qualitative approach is used to address the research questions in this study. The use of a qualitative approach is justified for research topics that are exploratory and emergent in nature as well as for studies that investigate complex and social phenomena (Creswell, 1998; Denzin & Lincoln, 2011; Patton, 2002) – both of which stands true for this study which aims to uncover the experiences of engineers’ transition to managerial roles. Further, within the broader umbrella of qualitative research approaches, a qualitative interpretive study is used as the methodological framework for the research. As described by Merriam (2009), an interpretive qualitative study is often used to “understand how people make sense of their lives and their experiences” (p. 38). With the primary focus of the research being interpretive in nature, owing to the interest to understand the experiences of transition from the recently transitioned engineering managers’ perceptions, an interpretive qualitative study is well suited to the study’s primary focus. Moreover, given the motivation to investigate the problem of career transition more holistically, including by uncovering several different aspects of the transition such as changes, new skill demands, and challenges, a mode of inquiry such as the interpretive study is well suited for the topic because it offers researchers the flexibility to address a wide range of research questions.

To employ an interpretive qualitative study for any given study, Merriam (2009) proposes a specific process which includes the following major steps:

1. To collect qualitatively rich data through interviews, observations or documents,

2. To inductively analyze the data by employing coding procedures to the end of identifying commonalities and patterns across the data in the form of themes or categories,
3. To provide rich descriptions of the themes or categories emerging from the coded data and to contextualize them in relevant literature sources.

One of the significant advantages of employing an interpretive studies approach to the research problem is the flexibility it offers the researcher to answer a wide range of questions. Specifically, a basic interpretive study is best suited for this study, given the motivation to explore the phenomenon of engineer to manager transition more holistically. Moreover, through this framework, I will not only be able to attend to my primary research problem relating to understanding the working experiences of the newly transitioned engineering managers but also uncover the complementary research questions related to identifying specific changes, new skills, and challenges associated with the transition experiences.

Initially, in seeking appropriate qualitative methodologies for this study, phenomenology and narrative inquiry were also considered as alternate methodological choices due to their emphasis on participant stories and lived experiences – which are central to the research interest (Creswell, 1998). However, the primary purpose of a phenomenological study (to understand the essence of experience) and that of a narrative inquiry (to interpret and to tell stories of individuals) (Creswell, 1998; Patton, 2002) were not well aligned with this study's objectives.

One of the significant limitations of a phenomenological methodology for this study is its constrained focus on the essence of the experience. Notably, by catering to the tenets of phenomenology, which is concerned with exploring the phenomena as experienced by the individuals, researchers are curtailed from exploring broader questions related to transition, such as how one might learn to transition into or adapt to a new role, or how career transition affects the subjects' competencies or other related aspects of the transition, etc., which are all central concerns of this study. In addition, as noted elsewhere, a phenomenological study is typically not concerned with uncovering commonalities in the phenomenon experience but rather seeks to find variation (Starks & Brown, 2007). Since one of the primary interests of the research study is to explore commonalities in transition experiences as well as in relevant changes, new skills, and challenges, a phenomenological approach was not an ideal choice for the study.

Narrative research also centers around exploring the lived experiences of individuals in relation to some experience or phenomena of interest. However, narrative research, as a single frame of inquiry has a number of inherent limitations that limit its suitability to the research questions posed for this study. First, while narratives or stories of the participants seem to be well suited for addressing some aspects of the primary research question, narrative techniques concerned with reconstructing the stories (Creswell, 1996) are not suitable for addressing the secondary objectives of identifying patterns of changes, skills, and challenges across participants, which are essential areas of interest for the researcher. Further, narrative research often seeks to present the final findings in the form of narratives. The very purpose of narrative research to tell stories (Chism, Douglas, & Hilson, 2008; Creswell, 1998) is not the main focus of this study. Hence, a narrowly focused narrative inquiry approach is not employed for this study.

In contrast, an interpretive qualitative study is well suited for the study because, unlike other modes of inquiry, it does not limit the researcher to cater to the specific purpose of the methodology used, such as understanding the essence of the phenomena in the case of phenomenology or reconstructing a narrative in case of narrative research. As aptly summarized by Chism, Douglas, and Hilson (2008), 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” (p. 52).

However, despite these advantages, the lack of more specific methods recommendations adds a significant limitation to the research, particularly in terms of validity and reliability of the study. To deal with these issues, further justifications and details are provided for the specific methods, frameworks, and guidelines employed in the study. Further, I will refer and adhere to the quality framework described by Merriam (2002) for interpretive studies as well as the Q3 quality framework developed by Walther, Sochaka, and Kellam (2013) (see section 3.6).

3.4 Data Collection

To address the primary goal of understanding the experiences of recently transitioned engineering managers, I conducted semi-structured interviews with 16 participants from the Tel company. The average duration of the interviews was around 60 minutes and the interview times across all 16 interviews varied in the range between 50 and 70 minutes. The interviews were conducted via Skype audio platform. Skype was chosen for the interviews as it was the most

commonly used meeting platform at Tel Corp. Virtual interviews were preferred instead of face-face interviews on the advice of the HR professionals of the Tel company. Since there were engineers working from different geographic locations, virtual calls were a common mode of communication at the company. All interviews were recorded using the skype audio call record functionality. I also used a recording instrument to record the interviews as a back-up option. I asked all interviewees for their permission to record the interviews before the start of each interview. And, with their permission, I began recording our interview conversations. The interview recordings were then transcribed verbatim. I personally transcribed 13 of the 16 interview recordings and used a third party company [Transcribe.com] to transcribe the other three interviews. For those transcripts that I did myself, I listened to the audio recordings at least once before I started with the process. This helped me remain closer to the data. To ensure accuracy across all transcripts, I began reviewing the transcripts for any errors while parallelly listening to the audio recordings. The next step involved cleaning the transcripts. This process entailed anonymizing names, places, and other identifiable information. I also cleaned the transcripts by identifying and removing redundant words and/or filler words such as umm, uhh, etc.

3.4.1 Participants and Participant Selection

I worked with the HR managers of the Tel company to recruit participants for the study. The participants for the interview were recruited through purposive sampling techniques (Patton, 2002). The data collection process began with me providing the sampling criteria to the HR managers. The following criteria were used to determine the eligibility of the participants were shared with the HR managers who assisted with recruitment:

- Must have an engineering or other technical degree,
- Must have transitioned from an engineering role to a managerial role within the last 6 months to 3 years,
- Must have transitioned from a contributor role to an engineering managerial role within the same company,
- Must have an official managerial title or job role,
- Must be in the first managerial role of their careers,
- Must have at least one person reporting to them, and

- Must be managing engineers and/or engineering projects in their current role as a manager.

These criteria were formulated in accord with the definitions and attributes of an engineer, manager, engineering manager, and the transition process as established for this study (see section 1.7). The sample participants were purposefully selected to ensure that they are well suited for this study's objective – to explore experiences of engineers' transition to managerial roles. The HR managers then identified and shortlisted all participants who met my recruitment criteria. They sent out an initial recruitment email (Appendix B) to all the shortlisted participants requesting their participation in the study. Initially, I had planned on recruiting 10-15 participants for the study, but the HR managers were able to recruit a total of 16 individuals who expressed their willingness to participate. I also intentionally requested the HR managers to recruit at least three women participants for my study to ensure a more diverse demographic sample, as I wanted to investigate transition experiences specific to women engineers, something that has not been explored much in prior literature. Our initial recruitment list only had one female participant, but after a few personalized emails and follow-up reminders from the HR managers, we were able to attract two more women to participate in the study. Although it would have benefited the study to recruit more female participants, we had a difficult time finding participants that met our criteria. However, the HR managers suggested that the sample identified was demographically representative of the population of recently transitioned managers and that there were very few women in managerial positions in the engineering and technical teams. I also wanted to diversify my participant sample by including representatives from diverse ethnic and racial backgrounds, but due to company restrictions, I couldn't delve into asking questions related to ethnicity, race, etc. This is a possible limitation of the study.

Once the participants expressed their willingness to participate, they were all sent a second recruitment email (Appendix C) requesting their time to fill out a brief demographic survey (Appendix D) and to pick a time slot for the virtual interview. The demographic information is detailed in section 4.1.1. Finally, through the use of sampling criteria and approaches specified above, I recruited a total of 16 participants for the study. Each of these participants was interviewed to gather insights on the research objective and questions. Although qualitative research proponents call for the need to collect interview data till a saturation point occurs (Patton, 2002), I was required to provide an estimated number of the participant sample size to the company before the study began. I was also required to conduct interviews for all selected participants in a

stipulated time-frame as suggested by the HR and hence, did not have an option to choose the sample size based on saturation alone. However, I assumed saturation would occur anywhere between 10 and 20 interviews. This assumption stemmed from prior exploratory qualitative studies that had participant ranges between 10 and 20 (Korte, 2007). Accordingly, I suggested the HR to recruit 15 to 20 participants to be on the safer side. And, I was able to recruit 16 participants for this study, which was in the average range for saturation for similar studies. Not surprisingly, the saturation for the interviews was also met around that sample size.

3.4.2 Interviews

Interviews are used as primary instruments for data collection for this study. It also aligns well with the methodological choice for data collection of a qualitative interpretive study. Meriam (2002) suggests that interviews are well suited for capturing an in-depth understanding of participants' experiences. While the use of interviews is established above, in the following sections, I will go into further details about the development of the interview protocol. The interview development is mainly inspired by narrative interviewing techniques (Jovchelovitch & Bauer, 2000) and critical incident techniques (Flanagan, 1954). These methods are employed to elicit grand narratives or stories of the participants' experiences, which are further analyzed to address the research questions presented above. In the following sections, I will describe the interview instrument and its purpose, the interview techniques, and the interview structure employed for the study. Through these discussions, I will finally present the interview protocol that is aligned with my research questions and methodological commitments (see Appendix A).

3.5 Interviewing instrumentation

For this study, a combination of an interview guide approach and a standardized open-ended approach, commonly known as the semi-structured interviews, are used. Essentially, as Patton (2002) describes an interview guide approach as a technique that seeks to provide interviewees with an rough guideline outlining the critical themes and/or issues that need to be discussed during the interviews without delving into the specific questions and the specific order in which the they were to be asked. Whereas, a standardized open-ended approach is described as a technique where the exact interview order, as well as the interview questions, are predetermined.

It is also presumed that all participants will be subject to the same questions in the same order without any leeway for deviation. For this study, the questions were structured and ordered, but I had the discretion to probe further on specific topics as and when required, outside of the set guide. The interview protocol, thus developed, was useful to the research and data collection process in many ways. First, the protocol ensured consistency in the data collection process by allowing all participants to respond to the same broad questions (Patton, 2002). Along with ensuring consistency, the protocol also allowed for follow-up questions to be posed as needed (Kajornboon, 2005; Patton, 2002). Such flexibility allowed the researcher to dig deeper into the participant's experiences of transition. In addition, these guides/protocols helped maximize the use of the given time slots with the participants, namely by providing a clear structure and direction from the very beginning. Because the interviews were “highly focused, the interview time is used effectively” (Patton, 2002, p. 346). Furthermore, having clear protocols also helped during the data analysis phase, when the responses were more easily grouped in alignment with the research questions. The reliability of the interview protocol was also enhanced by soliciting feedback during the data collection phase. As suggested by Milagros Castillo-Montoya (2016), such feedback can be obtained from other researchers and/or volunteers. Mainly, I obtained feedback from my research group at the very beginning of the data collection phase, which further helped me enhance my protocol.

3.6 Interview techniques and framework

The following techniques and approaches guided the development of the interview protocol, namely: 1) Seidman's interviewing techniques (Seidman, 1991); 2) the critical incident technique; 3) the narrative interviewing technique. These techniques also align with the methodological commitments of an interpretive qualitative study. Mainly, Seidman's techniques were used to guide the structure of the interview, and the critical incident and narrative techniques were used in the development of interview questions. The following sections will elaborate on the said techniques and their contextual relation to the development of the protocol.

First, the interview protocol structure and order were guided by Seidman's (1991) interviewing techniques. He prescribes a flexible set of techniques for effective in-depth interviewing that are well suited for gathering a nuanced understanding of the participants' lived experiences. This approach resonates well with the study, given its interpretive emphasis on

exploring participants' experiences from their point of view. Particularly, his suggestions on structuring interviews were used for the protocol design. Accordingly, a structured three-phased approach was used to get an in-depth understanding of the experiences. The three phases included: 1) initial interview with a focus on life stories; 2) the second interview with a focus on eliciting details of the experiences in question and 3) the third interview with a focus on reflection aspects related to the central theme. However, for this study, rather than a three interview approach, a single interview structured with the three-phase techniques were adopted.

Although Seidman (1991) advocates for using his in-depth interviewing approach as a single method of investigation, he encourages researchers to adopt and integrate other techniques as per their unique goals and requirements. As this study is focused on understanding the experiences of new engineering managers and their transition stories, narrative techniques (Jovchelovitch & Bauer, 2000) were also used in developing the protocol. Leveraging a combination of techniques is also supported by the methodological assumptions of a basic qualitative interpretive study. It gives researchers the flexibility to use a combination of practices to elicit rich stories and descriptions from the participants (Merriam, 2002). In addition, Seidman's (1991) techniques of eliciting rich descriptions of the experiences are complimentary to narrative interviewing techniques. The narrative research interview techniques were thus used for developing questions related to the primary research question (RQ1), focusing on exploring stories of engineers' transition journeys to managerial roles (refer to section 3.4.2.2 for more information on how these narrative techniques are used in developing the questions).

The critical incident approach was one of the other primary techniques used for developing the interview protocol. This technique includes a flexible set of procedures to be followed to elicit detailed responses by the interviewees related to a specific incident (Butterfield, Borgen, Amundson, & Maglio, 2005; Flanagan, 1954). Historically, the critical incident technique was used primarily for job profile evaluations. However, in recent times, the approach has been used to uncover other topics related to beliefs, suggestions, and opinions, and the like (Butterfield et al., 2005). Accordingly, this technique is valuable to this study as it helps explore challenges and new skill demands related to the engineering managerial role transition, namely by seeking critical incident responses from the participants. It is also used to extract rich descriptions of the situations participants encounter in their new roles. Not surprisingly, prior works on engineering practice have included critical incident techniques to collect data on topics related to job profiles,

competencies, attributes, and behaviors (e.g., Jesiek et al., 2013). Given its applicability to address the research questions, the critical incident technique is used for developing the interview questions (refer to section 3.6.1 for more information on how critical incident techniques are used in developing the questions). In sum, Seidman's (1991) techniques were used primarily for guiding the structure and order of the protocol, whereas narrative interviewing techniques and critical incident techniques were used for developing the specific questions that comprised the protocol.

3.6.1 Structuring and question design

As noted earlier, the interview structuring and ordering were guided by Seidman's three-phased interviewing techniques. However, unlike the prescribed three interviews format, I only conducted a single interview with each participant. However, the single interview protocol was structured in a three-part format mimicking the three phases approach of interviewing, as suggested by Seidman.

The first part of the interview protocol consists of the initiation phase. This phase (part 1) of the interview is considered crucial in any interviewing format. Several qualitative authors have been vocal in encouraging researchers to begin interviewing with questions that elicit rich descriptive responses (Jovchelovitch & Bauer, 2000; Patton, 2002; Seidman, 1991). Correspondingly, the first few sets of questions were targeted at uncovering lived work experiences of engineering managers as they reminisce and reflect on their journeys from being an individual contributor to their current role as a manager. This approach was inspired by both narrative interview techniques (Jovchelovitch & Bauer, 2000) as well as Seidman's interviewing techniques (Seidman, 1991).

Seidman (1991), in what he calls a focused life history interview, emphasizes the need to contextualize the participants' life stories with the associated topics of interest for the study. Although not a great deal of rationale is provided by Seidman on this point, Patton (2002), in acknowledging the importance of such an approach, suggests that "probes should focus on eliciting greater detail - filling out the descriptive picture" (p.352). Patton further adds that interview probes could be built upon the experiences narrated in the descriptions early on:

Opinions and feelings are likely to be more accurate and meaningful once the respondent has just verbally relived the experience. Thus a context is established for expressing feelings and

opinions, that is, grounding feelings and opinions in relation to experiences. Knowledge and skill questions also need a context (Patton, 2002, p. 352).

The questions surrounding the relived experiences of the research subjects also form the basis for my primary research question (RQ1) to explore the lived experiences of engineers transitioning into managerial roles. Hence, the focused life history question set was an important focus for the initial phase of the interview.

Along with Seidman's technique, the narrative interview technique was also used for developing the initial set of interview questions. This approach was especially useful to attend to research question RQ1, given its focus on exploring the lived experiences of recently transitioned engineering managers. In order to better elicit rich stories or accounts from the participants about their experiences of transition, some of the narrative interviewing techniques were helpful in developing appropriate interview questions. Below is a set of narrative interviewing techniques described by Jovchelovitch & Bauer (2000) for the initial phases of the interview, some of which were used in the study:

- The initial topic needs to be experiential to the informant. This will ensure his or her interest, and a narration rich in detail.
- The initial topic must be of personal and of social or communal significance.
- The informant's interest and investment in the topic should not be mentioned. This is to avoid taking positions and role-playing from the very beginning.
- The topic shall be broad to allow the informant to develop a long story which, from an initial state of affairs, through past events, leads to the present situation.
- Avoid indexical formulations. Do not refer to dates, names, or places. These should be introduced only by the informant as part of his or her relevance structure (p. 6)

In line with these techniques, the initial questions were constructed to ensure participants' interest in the interview and then probe about the participants' experiences of transition through broad-ranging questions. Some of these initial questions include: Can you tell me a bit about yourself? Can you describe your current job role? Can you walk me through your journey of transition from an individual contributor to an engineering manager? These questions helped not only provoke interest among the participants but also set the stage for them to provide rich descriptions of their experiences. Further, they also served to establish a context for the interviewees by providing direct inputs to my RQ1.

Once the context was established in the first part of the interview, the second part (part 2) of the protocol was geared towards specific probes related to the secondary research questions. This part of the protocol was inspired by Seidman's (1991) technique for a second interview, which calls for the need to elicit detailed responses to specific experiences. He suggests the use of probes that allow the participant to reconstruct their day or share specific incidents or experiences related to the topic. Thus, given the strong emphasis on specific incidents, a critical incident approach was used in the second part of the protocol. Questions seeking to elicit either a challenging or a rewarding work situation were used as probing questions in part 2. Additionally, specific experiences of the engineering managers' workday were also used to elicit further responses (refer to appendix A). In this phase, the primary emphasis was on critical incidents and specific responses to address secondary research questions related to identifying specific changes, challenges, and new skills.

Part 3 of the interview protocol was inspired by Seidman's (1991) third interview phase. In this phase, Seidman encourages the researcher to ask questions that can elicit reflective responses from the participants. In what he calls reflections on meaning, Seidman suggests that this phase will build on the previous phases as the participants reflect on their actions and provide much deeper insights related to the experiences under investigation. Correspondingly, the third part of the interview consisted of questions that allowed the participants to reflect on the changes, skills, strengths, gaps, and strategies they encountered and learned as they navigated various transition challenges. The questions in this phase helped address both the primary and the secondary research questions. Finally, the interview ended with a question that gave the participants a final say on the topic (Patton, 2002) (refer to Appendix A).

Further, a triangulation approach was employed to validate the data gathering, based on the assumption that such cross-references of data will increase the validity of the study. For triangulation, the data gathered from multiple interviews were triangulated not only within the 16 interviews but also with studies dealing with similar phenomena regarding the work-role transition. Some of these connections with prior literature are further discussed in Chapter 5.

3.6.2 Pilot Interview and Refining the Study Design

After getting the IRB approval for the study, I proceeded to conduct a pilot interview with a program manager, pseudonym Kris, who worked for Pi Corporation. I have known Kris for a

while now as my partner's colleague and as a common friend. During one of our previous conversations about my research exploring the experiences of transition, Kris showed interest in learning more about the study and its potential implications for recently transitioned engineering managers and early-career engineers. Upon request, he also willingly obliged to share his transition experiences and journey with me for my pilot interview. The main objectives of the pilot were to: 1) test the interview protocol and the questions, 2) practice interviewing with a familiar person, and 3) get a sense of the kind of data to be expected from the interviews. The interview helped me with all three of these aspects. Whereas the interview was relatively easy for the most part, owing to our familiarity, there were few questions that did not elicit any responses. For example, one such question was 'How do you characterize the growth from contributor role to manager role?' Through post-interview reflections, I realized that the question was vague and did not specify growth in any specific sense. I also realized that I asked a presupposing question very early on in the interview, making it difficult for the interviewee to respond. To this end, I decided to remove the question from the protocol. Instead, I focused on eliciting the desired response through a broader question: 'How would you describe the changes associated with advancing into the new managerial role, if any?' Similarly, I also realized that the interview did not go for as long as I would have hoped for. However, coincidentally around the same time, I also had a chance to discuss my pilot interview insights as a part of my paper presentation with the community at the FIE conference (Nittala & Jesiek, 2018b), where I received further feedback on the interview and the protocol. Based on this feedback, I added additional questions to the protocol and also made edits to the questions that did not elicit a response. Fortunately, I was also able to schedule another follow-up with Kris to test the revised protocol along with the additional questions.

3.6.2.1 Refining the study design

Initially, the plan for data analysis was to employ a thematic analysis approach to address both my primary and secondary research questions. Bearing that in mind, I began my thematic data analysis process with the pilot interview. However, as I started the analysis process with the in vivo coding procedures, I realized that the complexity of the transition process was not fully captured only through the thematic codes. I felt that categorizing data into smaller units did not adequately justify the holistic transition experiences that the individual shared with me – which was critical to my primary research question (Nittala & Jesiek, 2019).

Hence, to this end of representing the holistic picture of Kris's transition journey, I decided to create a third person narrative describing his journey, as an example. (see section 3.7 for more details on the narrative analysis approach). I then published and presented the single case narrative at a peer-reviewed conference (Nittala & Jesiek, 2019). Publishing and presenting this narrative at the conference helped me gauge the usefulness and relevance of presenting the findings in narrative formats. I received very positive feedback from the peer reviewers and the audiences at the conference, prompting me to replicate the process for the rest of the 16 participants.

3.7 Data Analysis

After making revisions to the data analysis procedures based on the pilot interview, I proceeded with the data analysis process in two phases. In phase 1, a narrative analysis was employed with a focus on the primary research question. In phase 2, a thematic analysis approach was used to identify commonalities and patterns in experiences relevant to both the primary and secondary research questions. Whereas for the primary research question, a combination of narrative analysis and a thematic analysis approach was used, for the secondary research questions, a thematic analysis approach was used.

In phase 1, I started my data analysis process using a narrative approach (Kellam, Gerow, & Walther, 2015; Polkinghorne, 1995). I began by analyzing and creating third-person narratives for each participant to describe their journeys of transition. For this, I first familiarized myself with the interview transcripts by listening to the interview recordings as well as reading through the interview transcripts. I read the transcripts at least twice to become more familiar with and connect to the stories of these individuals. For each individual interview, I then read through the interview transcripts to identify specific incidents that were relevant to the research objective, i.e., the experiences of engineers as they transition to managerial roles. I then chronologically arranged the incidents and identified quotes from the data that illustrated the narrative plot. I then used these materials to develop narrative accounts for each participant, interjected with my interpretations of their experiences and journeys. The narratives typically followed a sequence starting with the demographic and background information for each participant, followed by their motivation and intention for the transition. Next, the narrative plot included how these individuals experienced the transition, including what changes and/or challenges they experienced and how they navigated these new experiences. The narratives often conclude with a description of how the individuals

felt about their transition so far and the advice they would give to future managers. These narratives, in part, address my primary research question – to uncover how engineers experience the transition to managerial roles. My goal in crafting these narratives was to represent and share the stories of transition more holistically. It also provided a way for me to represent the stories of the transition of participants by staying closer to their own voices.

Once the narratives were drafted for all 16 participants, I then moved onto the second, thematic phase of my analysis process inspired by Braun and Clarke (2006). In this phase, I once again began by reading all of the transcripts as well as the narratives produced in phase 1. Reading these narratives and transcripts helped familiarize me with some of the commonalities and patterns that were emerging from the data. During this time, I also started annotating my thoughts and reflections on the interview transcripts, which further helped me with the coding process and the analysis. Next, I started to inductively code the data or assign meaning to the data one transcript at a time. These codes were very descriptive in nature and comprised of words or phrases taken from the section of the data being coded. This process is also called as In vivo coding or verbatim coding (Saldana, 2016). Then I began grouping some of these descriptive in vivo codes into higher-level codes that were more analytical in nature as compared to the earlier descriptive codes. Following this process, I was able to create a codebook that guided the rest of my analysis process. Specifically, I reviewed and analyzed at least seven interviews to develop the bulk of the codebook. Moreover, during this stage, I also referred back to my interview protocol to organize my codes, especially related to my secondary research questions. For example, my codebook included specific codes such as “changes,” “challenges,” “skills and strategies” that directly corresponded to my secondary research questions. Table 3.1 gives an overview of the codebook generated using the thematic analysis approach. I used Microsoft Word, Excel, and post-it notes to document my reflections throughout the process, as well as for developing the preliminary codebook. Once the codebook was developed, I used NVivo software to organize my transcripts and to deductively code all the data. However, as I was coding the interviews with the preliminary codebook, I began to notice a few other categories or codes emerging from the data that I had not considered earlier. Hence, I had to revisit my codebook a few times before finalizing it. This aligns with Merriam’s (2015) suggestion that researchers employing an interpretive qualitative research methodology are often required to move between the data starting with a highly inductive lens, followed by a hybrid inductive-deductive approach in the middle and a deductive approach towards the end.

Table 3.1. Overview of the codebook.

Code	Sub-code	Description
Personal Information		Includes participants' demographic and other relevant information (e.g., gender, interests, prior education, etc.). Also includes responses to the introductory question: Can you give me a short elevator pitch about yourself.
Motivation		Motivation/intentions for transitioning into the managerial role. This code also captures other factors prompting the transition in an individual.
Descriptions of transition		Descriptions of the transition experience from the participant's perspective.
Participants Job role		Participants' current job role. Includes all technical and non-technical dimensions of the job.
Prior Managerial experiences		All references to any informal or formal leadership or managerial experiences described by the participant.
Changes	Social/relational	Individual changes concerning the social aspects. These include social and relational interactions with colleagues, peers, etc., lifestyle changes, etc.
	Psychological	Individual changes associated with the psychological aspects of the self. These include changes in self, identity, persona, etc.
	Cognitive	Individual changes associated with the cognitive aspects. These include changes in memory, thinking, learning, etc.,
	Other	Other changes not listed above.
Challenges		Experiences related to the transition process described as being challenging or difficult for the participants.
Skills and strategies		Skills and strategies discussed in the context of navigating the new managerial role.
Learning experiences		Includes all experiences discussed in the context of learning and preparing for the new role and the transition.
Training needs		Training needs or gaps identified by the participants to improve their skills as managers and leaders.
Advice for future managers		Advice and/or suggestions provided by the participants for future managers.

Table 3.1 continued

Other		Other critical codes not captured by the above codes. These mostly included a) participants descriptions of least and most favorite aspects of their job roles
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The next steps included looking through all the coded data to identify themes or categories relevant to my research questions. Essentially, once I coded all the transcripts, I went back to the research questions to identify what codes corresponded to what research questions. I then grouped the codes according to the research question that they were addressing. For example, all coded data for changes – social, psychological, and cognitive were grouped together for addressing the secondary research question (RQ2). Similarly, coded data for skills and strategies were used to address the secondary research question (RQ3), and all coded data for challenges corresponded to RQ4. The rest of the coded data was used to address the primary research question (RQ1).

The next steps included a constant comparison of the grouped coded data across transcripts to identify common themes and patterns relevant to the research questions. As suggested by Merriam (2015), these themes or categories, thus developed must,

1. Be responsive to (that is, answer) the research question(s),
2. Be exhaustive (enough categories to encompass all relevant data),
3. Be mutually exclusive (a relevant unit of data can be placed in only one category),
4. Be as sensitive to the data as possible, and
5. Be conceptually congruent (all categories are at the same level of abstraction) (p. 213).

The themes and/or categories generated were broader and richer than the single worded codes used earlier. Once the themes were identified specific to both the primary and secondary research questions, I then identified relevant participant quotes from the coded data to support my themes. Leveraging these participant quotations, I ended the process by providing rich descriptions and my interpretations of the themes or categories that emerged from the data. This concluded phase 2 of the analysis process.

Correspondingly, the findings for the primary research question are also presented in two parts (refer to Chapter 5). In the first part, the narratives are presented, and in the second part, the common patterns or themes of transition experiences are presented. While there may be a bit of an overlap in the content and/or in the participant quotations between the narratives and the thematic

findings as they seek to address the same research objective, I believe that the two ways of presenting the findings are complementary (holistic and thematic) in nature and enhance the quality of the findings. More specifically, whereas the objective of the narratives is to present the unique stories of transition of each individual holistically, the thematic findings seek to delve into the specificities of the commonalities and patterns in the transition experiences across transcripts.

3.8 Validity and Reliability

Validity and reliability in qualitative research have been heavily debated in the recent past, especially for interpretive studies, resulting in inconsistencies on what constitutes these terms. However, to ensure consistency, I will use definitions provided by Merriam (2002) to check for the quality of this interpretive study. She suggests that internal and external validity, as well as reliability, are essential to enhance the quality and trustworthiness of the research. Internal validity concerns the appropriateness of one's findings in relation to the reality studied. External validity refers to the generalizability of the findings to other settings. And finally, reliability in an interpretive study can be accounted for by considering the question of "whether the results are consistent with the data collected" (Merriam, 2002, p. 27). Hence, to address the issues of quality and trustworthiness in an interpretive study, Merriam (2002) suggests several strategies for enhancing reliability and validity, which were used throughout the study design.

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. To address such issues, Merriam (2009) 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 are provided throughout the study. Additionally, the role of the researcher as the interpreter was also emphasized to give readers a better frame of reference for the interpretive findings (Merriam, 2002, 2009). Specifically, I also critically examined my biases and assumptions prior to the research and have stated them upfront in the researcher positionality section (refer to 1.1) to navigate the issues of reliability (Chism et al., 2008; Merriam, 2002, 2009).

Additionally, the Q3 framework suggested by Walther, Sochaka, and Kellam (2013) for engineering education research is also used as a guideline to check and enhance the quality of the study. The use of this framework is justified for its focus on quality management for interpretive

research in an engineering education setting – which is a central aspect of this study. They suggest a quality process model or framework cutting across five constructs of validity and reliability. These include 1) theoretical validation; 2) procedural validation; 3) communicative validation; 4) pragmatic validation; and 5) process reliability. Theoretical Validation pertains to seeking the connection between the theory generated from the data and the empirical reality that is studied. Procedural Validation corresponds to incorporating procedures throughout the study design to enhance the overall validation of the study. Communicative Validation includes seeking validation and co-constructing knowledge within the research community. Pragmatic Validation focuses on the question of whether or not the theoretical findings are applicable to the empirical reality. Process reliability seeks to “make the research as independent from random perturbations as possible” (p.649). The framework also proposes potential strategies to ensure quality management throughout the process, including while making data and handling data. Correspondingly, I have used a set of strategies to ensure quality across each of the five constructs mentioned above. The following table (Table 3.2) provides an overview of the strategies that were adopted throughout the research process, both while handling and making data.

Table 3.2. Quality framework (Adapted from Walther et al., 2013).

Type	Strategies for ensuring quality	
	Making data	Handling data
Theoretical Validation	<ul style="list-style-type: none"> • To ensure theoretical validation, I have explicitly articulated the research paradigm and theoretical perspectives that guide the study. • I also used purposive sampling techniques to ensure theoretical validation. 	<ul style="list-style-type: none"> • Alongside discussions on commonalities in experiences of transition, I also elaborated and presented all deviant and anomaly cases through my narratives and discussions. Specifically, I highlight and discuss variations in experiences of the female participants which differ from their male counterparts. • I have also adhered to analytical induction coding procedures during data analysis, which in turn could enhance the theoretical validation of the study.

Table 3.2 continued

Procedural Validation	<ul style="list-style-type: none"> • I developed the interview protocol using rigorous quality frameworks and techniques to avoid procedural validation threats during data collection phases • I have also employed critical incident techniques to avoid self-bias responses to the interview questions. 	<ul style="list-style-type: none"> • I have annotated and journaled my ideas, thoughts, and reflections while handling data to account for my biases.
Communicative Validation	<ul style="list-style-type: none"> • I have incorporated feedback from my research group and the FIE conference community on the interview protocol to enhance the communicative validation of my data collection processes. 	<ul style="list-style-type: none"> • I have also solicited feedback from my research group, the FIE, and the SEFI conference communities on my preliminary findings.
Pragmatic Validation	<ul style="list-style-type: none"> • The data collected was triangulated with other interviews and theories to ensure pragmatic validation during the data collection process. • The diversity of the sample participants and their exposure to the transition process will enhance the pragmatic validation of the study while making data. 	<ul style="list-style-type: none"> • I will be consulting with Tel corporation and/or other practicing engineers to inform them of the practical implications of the findings. To this end, I will also be re-contextualizing the findings to suit the pragmatic needs of the companies to enhance their engineer to manager transition pipeline.
Process Reliability	<ul style="list-style-type: none"> • I have checked all transcriptions for accuracy by revisiting the audio files. • I worked towards process reliability by iteratively working on improving the data collection processes. 	<ul style="list-style-type: none"> • I have used reflecting throughout the analysis process to enhance process reliability. • I have also tagged the quotes in the findings to the corresponding participants' pseudonym to enhance reliability. • The analysis process included identifying narratives and direct quotations from the participants to ensure the data is closer to the participants' voices as well as to ensure process reliability.

3.9 Limitations

In addition to the limitations stemming from the scoping and focus of the study, as discussed in Chapter 1, there are also limitations associated with the study design. First, one of the significant limitations of this qualitative study could be the lack of generalizability or transferability of the findings to other contexts or even larger populations. But, as Merriam (2002) suggests, transferability in an interpretive study could be achieved by providing rich descriptions of the findings for a particular context and letting the readers determine the applicability of the study to other contexts or cases. Hence, the limitation could be overcome to a certain extent by providing as much detail of the context as possible, so the readers can interpret the applicability of the findings to other contexts as needed.

Second, the lack of articulation of the participants' race and ethnicities is a major limitation of the study. As Pawley (2017) suggests, lack of focus on the diversity of the population sample must be recognized as a limitation in any study. While there was an intentional effort to recruit female participants, the organizational policies of Tel corporation did not allow me the flexibility to record the ethnicities or other related characteristics of my participants. Hence, the generalizability of my findings and claims to ethnic and underrepresented minorities is limited.

Third, as with any interpretive qualitative research, my role as a researcher in how I collected and handled data could potentially lead to some limitations in regard to the validity and reliability of the findings. However, to keep my biases in check, as discussed in previous sections, I have taken several measures throughout the design process. Some of these include: a) explicitly stating my positionality and biases, b) being transparent about my study design choices, c) following quality frameworks described by Walther et al. (2013) to enhance reliability and validity of the study.

3.10 Summary

In conclusion, the study design combined techniques adapted from various modes of inquiry rather than invoking only one specific methodology. Primarily, the narrative interviewing technique, critical incident approach, and in-depth interviewing techniques were leveraged for data collection, and narrative analysis and inductive thematic analysis methods were used in the data analysis process. Moreover, despite the inherent limitations associated with the study design,

appropriate quality measures were taken throughout the research process to enhance the validity and reliability of the study. In the next chapter, I present the findings of my study emerging from the data analysis processes described in this chapter.

4. FINDINGS

The primary objective of the research study is to understand and describe the work-role transition experiences of engineers moving into managerial roles. The study seeks to specifically understand the personal changes experienced by the newly transitioned managers and their difficulties in coping with these changes. In this chapter, I will present the findings related to these questions. As noted in the methodology section (section 3.3), the data for analysis comes from the 16 semi-structured interviews from newly transitioned managers of the telecom company. The findings in this chapter are organized into two parts. In the first part, I discuss the findings related to my primary research question, RQ1: How do engineers experience work-role transition as they move into engineering managerial roles? This part includes the participants' demographic information, followed by the individual participant profiles and personal narratives of the transition experience. In the next part, I present my thematic findings for both my primary research question as well as my secondary research questions: RQ2: What personal changes do engineers experience as they transition into engineering managerial roles; RQ3: What new skills do engineers perceive as critical for their survival and success in their new roles?; and RQ4: What challenges or difficulties do engineers face as they transition into managerial roles? I also include descriptions of the participants' schema of the transition experience, the personal changes they experienced, the new skills they had to develop, and the challenges they had to navigate to transition into managerial roles.

4.1 Research Question 1

As discussed in the methodology section earlier, the data analysis for RQ1 was done in two phases. In the first phase, individual stories and journeys of transition for each participant are presented as short narratives. In the second phase, a thematic analysis was conducted to identify common themes of transition experiences across all participants. In this section, I present each participant's demographic information, followed by the individual narratives and then the common themes of transition experience across all participants.

4.1.1 Demographics

Demographic information is provided for all 16 participants in the study. Table 4.1 gives an overview of the participant information, including gender identity, major and highest degree earned, total years of work experience, and the number of people reporting to them in their current managerial role. This demographic information provides contextual information for the participants' transition, while the individual narratives depict a more nuanced picture of the transition journeys for these individuals.

The details in Table 4.1 are only intended to provide more contextual and background information of the participants of the study. It by no means paints a complete picture of the transition experiences of the participants. The individual narratives detailed in the following subsections provide a more holistic view of the participants' journeys. Pseudonyms are used instead of the participants' actual names to maintain anonymity for security and privacy reasons.

Table 4.1. Summary of participant demographics.

Participant name (pseudonym)	Gender identity	Bachelor's degree major	Total years of work experience	Highest degree earned	Pursued a business-related degree? If yes, Degree	Number of direct reports in current role
Matt	Male	Electrical Engineering	24	Bachelor's	No	6
Rene	Female	Computer Science	19	Bachelor's	No	8
Scott	Male	Computer Science	14	Master's	No	18
Samantha	Female	Electronics and Communication Engineering	27	Master's	No	11
Pete	Male	Production Engineering	21	Master's	No	16
Kevin	Male	Electronics and Communication Engineering	12	Master's	Yes, Master's in Business Administration (MBA)	7
Usher	Male	Computer Science	20	Master's	No	100
Steve	Male	Computer Science	15	Master's	No	32

Table 4.1 continued

Samuel	Male	Computer Engineering	17	Master's	Yes, MBA	20
Travis	Male	Industrial Engineering	25	Bachelor's	No	2
Andy	Male	Industrial Engineering	17	Master's	No	65
Leo	Male	Computer Engineering	24	Bachelor's	No	17
Justin	Male	Electrical Engineering	21	Bachelor's	No	12
Lily	Female	Information Systems Engineering	18	Master's	Yes, Master's in General Management	8
Seth	Male	Computer Science	14	Master's	No	100
Adam	Male	Electronics and Communication Engineering	22	Bachelor's	No	18

Overall, the participants recruited for this study comprise of the following characteristics:

- Engineer (or Computer Scientist) who recently transitioned into engineering managerial roles.
- Employed at Tel company
- Having at least 6 months of experience as a manager
- Having fewer than 3 years of experience as a manager
- Three self-identified women
- Three participants who received a business related Master's degree
- Having more than 1 direct report as a manager

All participants were mainly employed by either the [Engineering Group 1] or [Engineering Group 2], both part of the larger engineering and/or technical division within the company. Within these groups, the participants were part of a diverse set of departments and teams. However, to maintain anonymity of the participants and the company, the team or department names are not provided in Table 4.1. The participants also held various titles as managers. This was not included in the table as well for anonymity issues.

Besides, as noted in the earlier chapter (refer to section 3.4.1), I was also intentional about recruiting a diverse set of participants. While I was able to recruit at least three female participants,

I wasn't able to delve into participant details pertaining to their race, ethnicity, or citizenship due to organizational constraints. The details provided in Table 4.1 are meant to provide a typical discretion of the study sample as well as to set a context for the individual narratives. In the following section, I present the participant profile and narrative of each of the 16 individuals.

4.1.2 Participant Narratives

The individual profiles and narratives are intended to provide readers with the stories of each participant's transition in their voices. Through these narratives, I also seek to highlight the unique journeys of transition experienced by each participant. The narratives follow a consistent pattern of organization. Each narrative begins with a brief overview of the participant's background and demographic information, and then describes details of their career progression. These descriptions include aspects such as participants' motivation for transition, how they perceive the transition, any personal changes and/or challenges that they experienced, the skills or strategies they adopted to succeed in the transition, their preparation for the transition, and finally words of advice for engineers looking to transition into managerial roles.

These individual narratives are all constructed by me and presented from my point of view as an author. These narratives include participants' voices as quotations intertwined with my analysis of their experiences. All quotes are edited such that references to identifiable groups, persons, titles, and/or places are masked to maintain the participant's anonymity. Although one primary objectives for the narratives is to provide a holistic representation of each participant's journey, it is essential to note that not all experiences discussed by each participant are highlighted in the narratives. Only those experiences relevant to the individual's transition experiences and catered to the research questions were highlighted. For example, a few participants shared in-depth details of their current job roles, their technical project details etc. These were not drafted into the narrative as they did not fit the narrative plot of transition experiences. The narratives are intended to help readers understand the unique journeys of transition experienced by each participant and appreciate the commonalities and differences in their experiences. The narratives are constructed based on the interview data and follow a thematic narrative approach described by Kellam et al. (2015). Additional details on the approach are provided in Chapter 3: Methodology. The following sub-sections present the narratives for each of the 16 participants.

4.1.2.1 Individual Narrative 1: Matt

Matt is currently working as an engineering manager at the Telecom company. He oversees two mid-western cities' market-level teams and has 6 direct reports working with him spanning the two towns. Before this role, Matt had a long and exciting career as an individual contributor and an engineer in the Telecom industry. Matt started his career as an individual contributor in the telecom industry in the early 90's. Although, for the most part, he continued as a technical contributor, Matt did morph into an informal managerial role at one point in his early career, where he oversaw project management. However, that did not last long as he had to switch companies, which prompted him to "step down" into a technical contributor role. Finally, he transitioned to a formal managerial role (his current role) after being in a technical role for over 20 years. This interview was conducted when Matt was close to one year into transition into the managerial role.

Matt's transition into his current managerial role has been very sudden. For him, the transition was "very dry and cut out" and "out of the blue." Though Matt considers the managerial role as a better career opportunity as compared to the individual contributor role, he never fully planned for the switch. In fact, he was quite content with his previous technical role. However, a reorganization in the company opened up this opportunity, and he instantly seized the opportunity as it aligned well with his past experiences.

I applied for the job. I had to interview for the job, and I got the job. And then there it was- I was the manager. There wasn't like a cross over and it wasn't like I was just morphing into a role. I was a manager, boom, the next day. So, for me it was the people I was working with as peers one day, and the next day essentially, they were reporting to me.

The hardest part of the transition for Matt was figuring out how to balance the technical and leadership aspects of the managerial role. He also struggled to identify what technical aspects of work he had to let go and what to focus on as a manager. As he states, "Cause obviously I can't do everything (laughs) that engineers do because I just don't have the time and that's not in my scope." Further, detailing the difficulty in treading the technical and people management aspect of his job, Matt states:

The hard part was to know what to focus in on as a manager, what technical points to both manage the market and be the leader and be a role model or a mentor to them [employees]. To grow them. So, you know, that was really where the transition for me was - what to let go of and what to still to remain focused and sharp on.

Additionally, Matt also experienced a personal change in how he interacted and dealt with his direct reports, who were once his peers working in the same level. This was a rather difficult and challenging change for Matt. As a manager, he was required to oversee his direct reports and track their work updates. However, Matt struggled with this change as he found it hard to get involved in their work without making him seem like he was bossing them around.

With the change, my feeling was how do I get these guys, the engineers, how do I get involved with what they do on a technical basis? And not seem like I'm sort of like the manager over their shoulder?

However, Matt quickly overcame this difficulty by improving the way he communicated with his team members. His strategy was to organize more weekly team meetings, where everyone was encouraged to share their weekly updates, which worked well for everyone. As he explained:

I tried to do more communication. I set more of a protocol of how to communicate, and a lot of it was done through my weekly staff calls. And you know I started taking notes there on what projects everybody's working on, so that was not only a way for me to know what they were doing, but they can update the rest of the team too. So, it wasn't just like me seeming like I'm over their shoulder saying, "Can you tell the team?" What you're working on, how's that going? Where we at? You know, or explain how this works, we need to know 'cause everybody can't work on the same thing. So, kind of put it in more of that premise.

While Matt faced several changes and challenges associated with transition that he was mostly unprepared for, he acknowledges his preparedness in dealing with some of the aspects of the changes from his earlier roles. For example, he believes that the previous informal managerial experience helped him better see the realities associated with a managerial role. In other words, the difficulties or challenges that accompanied the transition were not as surprising as he was initially expecting. As Matt summarized:

I think that's where maybe my past experience helped. Even though it wasn't as formalized and wasn't as big as a psychological change for me, individually, I kind of knew what to expect and had some experience with that.

In addition to the previous leadership experience, Matt also advocates seeking and reaching out to colleagues and mentors for help. He reported that doing so helped him personally transition into the new role smoothly. Moreover, in describing other skills and competencies as essential for the transition into the new position, Matt emphasizes the need for having sufficient technical skills and aptitude. He believes that technical skills are hard to learn once in the managerial role, and hence, engineers should have at least a high-level understanding of the technical skills required for

the role. In addition to the technical skills, Matt also highlights the need for engineers to develop good communication skills that he considers essential for the new role as a manager.

Well, essential I think still has to be some type of solid communication skills. I mean, sometimes there's technical people that just don't have very good communication skills. And I don't think most of the time they become managers, but you know every once in a while you'll see one and it's often a mistake and doesn't have good results.

Reflecting on his own experiences and his journey into the managerial role, Matt's advice to engineers looking to transition into managerial roles is: a) to understand how each individual is different and to develop the skill for dealing with people having different personalities and working styles; b) "to stay on top of your market," ; and c) to seek out opportunities to connect and interact with leaders.

4.1.2.2 Individual Narrative 2: Adam

Adam is currently working as a technical manager, leading the [Engineering Function] development team of his company. In this role, he oversees several aspects of [Function] development and engineering, including product integration and vendor management. He has 18 direct reports who work with him on all these aspects of the business. Before this role, Adam worked as an engineer and an individual contributor for over 20 years in various companies spanning different continents. Adam started his career in the early 90s as an engineer and has worked in several countries before moving to the United States, including India, Poland, Germany, etc. In the middle of his career, he took on responsibilities as a project lead for a short span. Still, it was mainly limited to overseeing a timeline for one aspect of the project with no formal managerial duties. Soon after that assignment, he joined the current company and went back to doing engineering work as an individual contributor. Finally, he transitioned into his current managerial role after 7 years with the company. At the time of the interview, Adam was about 1 year into the transition.

Adam's foray into the managerial role is primarily driven by his motivation to get into a leadership position. Despite not holding any managerial roles earlier, Adam showed keen interest in learning about and working on the budgeting and financial aspects of the business, even in his earlier roles as an individual contributor. This interest further prompted him to intentionally seek out this opportunity as a manager for his next career move:

Actually, that was always what my goal was- to kind of get into a leadership role. That was definitely one of the motivational items that I had. Doing technical things for so many years I thought of taking up a new challenge, and obviously to get into a leadership role understanding the finance side of the house was very important.

Adam also acknowledges that a lack of a clear path in the technical stream contributed to his transition, and explains that he may have been still an individual contributor had he been presented with challenging opportunities to grow within the technical path. However, Adam seems content with the transition and is learning a lot in the new role. Mainly, he sees this role as an opportunity for him to grow personally and professionally. In one instance, in describing this transition opportunity, he states:

I'm pretty sure you know that was the highest basically level you could reach, from the technical aspect. It's kind of equaling to the management rules. But the good thing is here [in the managerial role] I can really then develop myself into a different role of resource handling and basically improve on the communication skills and taking your focus little way away from the technical aspects and look over at bigger picture. Right? So that was the main reason I worked with my previous manager to see transitioning into this new role.

Despite making an intentional choice to move into the managerial role, Adam's transition wasn't without difficulties or challenges. Coping with the new role was very stressful for him. One of the main challenges that Adam faced as he transitioned into the managerial role was dealing with the increased responsibilities and scope. He was responsible not only for himself but also for his entire team. It was quite an overwhelming experience for Adam, as he recounts:

I would be very honest, and I mean, it's a different ball game altogether. You know the people around you, that's one thing. But now, kind of basically leading that role as a manager, right? Making sure that people are highly motivated, and their concerns must be addressed fully. Also, I mean the engagement and the escalations happening on the individuals have to be taken care of in a good way. Working with the individuals and obviously with the cross-functional teams. So that was quite an experience for me, no doubt about it, and did it bring stress up? Yes, absolutely, it did.

This additional responsibility of taking care of the team encompassed aspects of care and well-being of the team members. At times, Adam also faced an increased emotional burden as he had to deal with the personal problems that his direct reports had, which impacted their work-life. For example, in one situation, Adam had to deal with a team member who was facing a family problem and ensure that she got a break from work, including going the extra mile to find her a temporary replacement. Situations such as these increased the scope of Adam's responsibilities and

introduced new emotional burdens, and it took him almost a year to finally get comfortable with the increased stress levels.

Yet, in addition to the challenges, Adam also experienced several more positive and less challenging personal changes as a part of the transition. For instance, he had a change in his mindset from solely thinking about himself to thinking about the team. Adam reported feeling optimistic about this change and viewed it as a definitive personal growth:

In many aspects, you don't think about yourself. You have to think about the entire team. Make sure the team members are fully grouped with what and how they want to complete the work. Obviously, thinking about others. Now, to be honest, that thinking was not there prior to this new role. I see that as a positive change.

Likewise, Adam also experienced other changes, but he could cope with them better due to his prior experiences. For example, his experiences working in different countries helped prepare him to deal with people from diverse backgrounds. Moreover, his experiences working in Germany helped him adapt to the new managerial role's increased cognitive load. Specifically, he attributes his methodological mindset that he developed while working with the Germans as critical for handling the increase in mental load associated with the managerial role. In addition, Adam sought out mentors who helped him with the transition process. Even before his transition, one of the mentors he found via a company-organized leadership program helped him prepare for the different scenarios and plausible, challenging situations in the new role. As he explains:

Back in [year], I did this organizational leadership development program [OLDP]. I had a director who was my mentor. I had a very good interaction with her. Meeting her on a weekly basis, we would go through the different scenarios. I would react, and then she would help me even kind of, how do we improve on that, how to challenge the people in the right way. That kind of learning came from that program, which obviously is a lifetime experience.

He also found another mentor in his manager, who helped ease the transition process for Adam. Mainly, Adam's manager was a contact point for him to seek help and ask questions about managerial activities during the transition process. In terms of specific skills and strategies essential for the transition, Adam lists communication skills as being extremely important. He learned to up his communication game only the last few years or so and thinks it is beneficial, especially for technical contributors. He also stresses the importance of learning how to communicate technical work to the upper management as he offers this advice for new managers:

Obviously, the communication skill is one thing that a manager needs to focus on. First identify who your audiences are and based on that you have to deliver your

message because sometimes we have seen, we go too technical and all that in front of the management and they lose interest after a little while.

The other aspect that he emphasizes throughout his reflections is working with people. Adam strongly believes that developing teaming skills and knowledge of working with people is crucial to be successful as a manager. This is evident when he advises all new engineers to prioritize their teaming skills:

The industry we are in, basically, you can deliver 200% or more, but there will always be dependency on other team members. The projects are so huge. Everyone has to contribute. That is one thing. As long as you have good relations with your peers, good relations with other teams, things become much easier. That would be the first step, I would say.

A little over a year into the transition, Adam feels like he is growing in the new role. He also feels like he is liking the role and is adapting to the changes being thrown at him. He is prepared to learn more and to become a more successful manager as he looks to the next two or three years.

4.1.2.3 Individual Narrative 3: Rene

Rene is a Computer Science professional and has worked in the systems analysis side of the technology as an individual contributor for around 20 years before moving into her current role as a Manager of [function] within the firm. In her current role, she leads a team of 8 direct reports to facilitate data-driven IT and product solutions to the networking engineering teams. At the time of the interview, Rene was close to a year into the transition.

Rene's transition into the managerial role was "purely accidental." Going into the managerial or leadership pathway was not something she envisioned before this role. On several occasions, she recalls being very content in her prior job roles as an individual contributor. She even considered not taking up a managerial role that could potentially entail moving away from her family to another city. Yet, when she was presented with this opportunity in the same town, she took a leap of faith and grabbed it. And it turned out to be a great move for her, as she is pleased with the transition. As she explains, she is glad she decided to move into the managerial role:

My journey was entirely accidental. I'm very happy to be here. I love it. I feel very grateful. It's just been accidental. It's not something I regret; it's just if you'd ask me nearly 20 years ago when I started, I wouldn't have thought I would have been here. I have always been an individual contributor, being very content doing that.

Further, Rene has consistently doubted herself even as she stepped into the managerial role, explaining that she was not confident of her abilities to handle the managerial position. In several instances, she is seen crediting her previous managers for believing in her and grooming her into a leadership persona. She also often de-values her worth and is not very confident about her abilities as a manager. In describing her transition journey, she states:

The unique part underneath all of that is that I have been very blessed to have leaders around me that saw something in me that I didn't even actually see for myself, and they, unknowing to me, groomed it. This most recent person who promoted me to manager has been willing to take a risk on what he believes is there inside of me, and he's grooming it out of me, working with me to continue to grow my leadership. So I'm unique in the sense that I have stepped into management without actually probably having that much of a deep belief in my ability to manage.

Rene's lack of confidence further made the transition experience more difficult for her. As a manager, she is often required to lead her team members with confidence. For Rene, this was a rather difficult change to cope with, as she always considered herself a humble person. However, with her mentors' help, she eventually learned to be more confident in meeting the new role's demands. As she describes:

Since I'm the manager, my current leader is challenging me to be more confident while still being humble, and so I'm working that change. Because again, I think that is a quality that a leader should have, being confident that I can do this and lead my team and then to prove myself I am the right person, the right leader they hired. So that's kind of been a psychological shift for me to own that I can do this.

The transition also brought about a change in the work-life balance for Rene. Before the transition, Rene always prioritized her family time and worked towards finding the right balance between her personal and professional time. With the increased responsibilities of the new role, Rene found it challenging to find that balance. As a manager, she was now required to attend to calls and meetings even after her work hours and weekends. However, she quickly adjusted to the change and additional work demands by making some adjustments to her personal schedule, including by working late at nights after spending time with her family:

I'm making the conscious changes. And putting expectations on myself for my work-life balance has been super important. I, you know, I still take my daughter to school every day because that's still important to me. I still have also chosen to only work late at night after my daughter is in bed. And my husband and I have had our own, we call it face to face time, and then if necessary, I will work late that night to get caught up or whatever. So, it has been a change because I didn't have

to do like late evenings or early mornings and things like that in my previous individual contributor role, so just finding that balance was different.

Additionally, Rene has observed some positive changes in herself due to the transition. For instance, she noted a shift in her thinking abilities. With a vast portfolio under her belt, she is often required to keep track of all the myriad details associated with the on-going projects and leading multiple people. This helped her polish her cognitive abilities as well:

So I'm finding that my brain is getting used a lot more or in different ways, and the different ways it's getting used is mainly keeping track of where all these different projects are and remembering details, and sharpening.

Despite all the changes and challenges, Rene quickly morphed into her new role. Her managers and mentors played a significant role in helping her transition into the role relatively smoothly. Rene sought out their help by asking more questions without hesitation. She also sought out feedback on her work. They were not only helped by answering all her transition-related questions but also helped boost her confidence. As she elaborates:

So he [my previous manager] was easily the first person I would go to and say, "I need help with this. I need help with that. Can you coach me here? I want to learn this part about being a leader, and what did you do in this type of a situation?" I just had oodles of questions. There's another manager in my organization who, for years, I have told that person, "You are my unicorn. You are the manager I have always wanted to work for and have yet never worked for." I've actually almost worked for the person twice, but we keep getting ripped apart. So instantly, it was an email to this person. "Can we meet on a regular basis? Monthly, I will come with questions, concerns. I will want feedback."

Rene has also volunteered to offer several mentoring opportunities for new hires in her prior roles as an individual contributor. As she asserts, this experience has prepared her well for the mentoring needs of the managerial role:

I absolutely think it [mentoring experience] helps me because in my opinion, a leader is not just somebody who has the title of boss above me and makes my hiring and firing decisions; a leader is someone who can guide and who can understand what it is I have to do on a day to day basis, and who can help me do it when it gets too challenging for me, or I need assistance. And so having been an individual contributor and mentored people so that they can learn how to do their job is absolutely a skill I'm continuing to use now that I have an official title of manager. When I talk with my people and they're asking me questions, I can, I just put right back on that mentor hat and say, "Okay, well, if I'm gonna play teacher here," which I love and think that is an aspect of teaching as well, and I use that.

Rene additionally emphasizes the need for executive communication for all new managers in terms of other skills and strategies as being critical for the transition. Although Rene had prior expertise in written communication, she was initially having difficulty communicating and presenting technical summaries to her executives. However, given the criticality of technical communication in her current role, Rene has been religiously working towards honing that skillset. In other instances, Rene talks about using somewhat of an unusual strategy for information gathering. Notably, for getting people to give as much detail as possible during meetings, Rene opts for a strategy of “playing dumb.” She believes that playing dumb in meetings helps her extract all the needed information from her team members. As Rene notes:

One of my biggest tools that I used was playing dumb. I would play dumb all day long. So I've gotten really good at being okay with people thinking I am dumb (laughs) because it facilitated what I needed out of the purposes of whatever discussion I was having. Playing dumb in the sense that I would ask really elementary questions. I would make someone have to explain themselves and, and all that, and pulling and prying and getting information out, but at the same time, being okay that they didn't like I was asking so many questions, so that last half, being okay, asking questions... and that is a skill that I have used greatly here.

Reflecting on her own experiences, Rene advises all new managers looking to transition to seek out opportunities, including any informal leadership roles where they can lead smaller parts of a project or even mentor a few people. She also strongly advocates for engineers to do more than just sit in their cubicles and code all day. Instead, she believes that engineers should put themselves out there, always looking for opportunities, however small they may be:

You want to be a leader, then just don't be really, really good at just coming in and standing on the assembly line. Keep watching for those good leaders, and then go learn skills from them and put yourself out there to try out those skills before you actually have to use them in your manager role.

With less than a year of experience in her new role, Rene feels like she has had a great learning curve, especially over the last few months. She is consistently looking to better herself as a leader. With the help of her mentors and managers, Rene is also constantly updating her skill set to be a more effective manager.

4.1.2.4 Individual Narrative 4: Justin

Justin, an electrical engineer by profession, is currently working as a [Function] manager in the company. Before this role, he worked mainly as an individual contributor in the same

company in different positions. After working with the [Function] group for around 19 years, he moved on to a managerial role in the same team. At the time of the interview, he was in his second year into transition.

Justin's transition to the managerial role has been very sudden and was that of chance. Justin recalls not having any strong desire to move into a managerial role earlier as an individual contributor. Justin was quite comfortable in his role as a contributor because he got to stay closer to his family. Taking up a managerial role meant uprooting his life in his current city and moving to another town that wasn't aligned with his priorities. However, a recent company situation prompted him to reevaluate his profile as he believed having only a history of technical experience wouldn't make him a valuable resource to the company. This further motivated him to diversify his portfolio as a manager.

I'm in my 40s, and I don't have the management experience. If we all get laid off tomorrow, I'm going to be in a difficult situation. That was my primary goal, was just to expand my resume a little bit, get some more management experience.

And, when the opportunity for his current role opened up by chance, he took it without any hesitation. Despite not making a thorough pre-planned move into the managerial role, Justin's transition worked out well for him. In his own words, "the transition hasn't been bad at all." However, the transition experience wasn't entirely without any hiccups. Due to the transition, Justin faced a few personal challenges, a few of which were particularly challenging and difficult to cope with. For example, he has been consistently challenged by not knowing how to move from doing the technical tasks himself to delegating the tasks to his team members.

It's hard to delegate, I think. I see that in some of the other managers too. The phrase everyone uses, it's easier just to do it yourself than to teach someone how to do it over and over again. That's probably the biggest challenge, is just to let go of some of the responsibilities. Which I still need to do. There are still things I'm doing that I shouldn't be doing.

Justin also has a hard time perceiving himself as a manager. Due to his long training as an engineer, he still identifies himself as one. Unintentionally, he always ends up describing himself as an engineer first. This, in part, could be explained by his lack of awareness of what the role entails. He acknowledges the mismatch in role expectations and reality. Specifically, he is caught off guard with the amount of people management the managerial role encompasses for which he isn't necessarily prepared for.

I guess it was less of the people side of it, I thought, or I didn't know took up so much time. Just managing people, not so much managing networks. That's something I had no idea that was such a big part of this role. It's never been brought up. I mean looking back now, yeah, sure, it makes perfect sense. It's going to be a huge part of this job.

Also, Justin has other areas to develop to grow into the managerial role fully. These include having more effective conversations with people across functions and hierarchies. These gaps make him believe that he still hasn't fully transitioned into the new role yet.

Although he didn't have any significant managerial or leadership experience, Justin's primary sources of help have been his mentors and previous managers. On several occasions, Justin recalls bouncing off ideas and questions with his mentors. Even though he did not intentionally and formally seek out a mentor, to begin with, Justin forged a mentoring relationship with his previous managers. He describes it as a more organic relationship. Justin benefitted from these mentors as he had someone more experienced to seek answers to all his transition-related questions.

One of the other managers was actually my former manager, that I worked with daily. He's been a mentor of sorts. A lot of questions I'll bounce off him, before I'll ask my Director. For the transition, Justin realizes that executive presentations and resource management are two of the major skills that are critical to succeed in the new role. Although new to him, Justin consistently tries to improve his executive communication skills as he considers it essential for the new role. Executive communication, including making visual presentations and relaying concise information to the upper management in an efficient manner.

There's still some things that I'm sure I need to brush upon. For example, probably the biggest thing is presentations. There are a lot of things that we spend a lot of time coming up with data, and reporting, and cause and effect. But we have to have the right font color. We have to have the right indents on paragraphs. We have to have the right font. We have to have the [company] font. Those are the things that are very hard for me to keep focus on. They are as important as everything else. No matter what the content of a PowerPoint deck is, it's going to be being read by our upper leadership. All those things they're probably more important than actually the content of the presentations. Those are some things that I'm realizing I need to work on those. It's managerial, and it's less about data and more about, I guess, presentations.

In addition to communication skills, Justin realizes the importance of resource management in his new role. Particularly, he recognizes that finding the right people for the right job is an

extremely valuable competence for navigating challenging projects and timelines. Despite not being used to dealing with people as much, Justin picked up this essential skill just of resource management within a few months into the transition. He has also been able to identify and allot tasks that align with each individual's work preferences to keep them motivated.

I guess the biggest thing is finding out what people are good at. I'd only been in the role for a few months, but learning who else is good at delegating, who else is good at running this piece of equipment, who's good at analysis, who's good at just odds and ends, and who just needs to stay out of the way, because they're going to get stressed out, and have that person go get sandwiches, and keep everyone else happy for the day. I guess finding out who's good at what and setting them on task.

Justin's advice to new managers who are looking to transition into managerial role is to a) seek project management experience via classes or real-time; b) to get some budgeting and business-related experiences; c) to improve presentation skills and d) to make the transition early on in their careers and grab any opportunity that comes along the way rather than to wait indefinitely for something to be handed over eventually.

Into his second year as a manager, Justin feels like he is settling into the new role. He also acknowledges the need to seek further training and developmental opportunities that would help him in the new role better. And is more focused on maintaining the work-life balance that got impacted a little due to the transition.

4.1.2.5 Individual Narrative 5: Lily

Lily, currently a manager of [Function] and has been with the company for several years. Before the transition, she has worked primarily as an individual contributor in several roles, mostly in the [Function] domain within the firm. She has also briefly experienced informal management in her short stint as a program manager prior to this role. As a program manager, she oversaw a few aspects of a technical program but had no formal direct reports. Unlike some of her counterparts, Lily has also taken a 7-year long hiatus from work to raise a family. After this, she once again joined back the company as a technical contributor. And, eventually moved into the current role just around a year ago (at the time of this interview), where she now oversees several product development projects with the help of 8 direct reports.

Lily's transition to the managerial role wasn't intentional. She recalls not having any specific plans to move into the managerial pathway. But she was often told by her managers that

the managerial pathway was right for her. She also credits her managers for “grooming” her for the leadership positions from the very early stages of her career. Although she moved into the current role as there was an opportunity that aligned closely with her experiences, Lily still feels that she would have chosen a more technical role. The company offered better pathways and challenging opportunities to grow further in the technical contributor role.

Owing to her past experiences as a project/program manager, where she pursued informal leadership roles, the current transition experience to the new managerial role doesn't seem quite overwhelming. She is vaguely familiar with the expectations of the new role and the difficulties associated with the transition. In her own words, the transition didn't feel “foreign.” However, since she did not have formal managerial experience yet before this role, the current transition did bring about some personal changes for her, some of which were quite difficult and challenging. One such major challenge that Lily faced due to the current transition was maintaining the work-life balance. Whereas her previous role as an individual contributor role offered her flexibility to work from home quite often, the managerial role mandates Lily to be present in the office as much as possible.

I think there is one distinct impact to work-life balance. When you're a manager, you do not have the option to work from home. It's just a specific change that you have to accept. Definitely, from that perspective, it is nice to be close to home on occasion where you can finish your workday, and you're there.

The other challenge is dealing with multiple project deadlines and deliverables. Although Lily is an extremely organized person, she still struggles to keep up with the myriad of things thrown at her in her new role. The new role brings a change in her cognitive abilities as it's challenging her to pay attention to a lot more details than she was used to. Due to this, she is consistently learning new ways to be more organized to meet the requirements of the new role. One of Lily's strategies to navigate this issue is shifting from manual note-taking to online note-taking. Since she is now responsible for multiple projects and people, manual notes weren't as useful. In her previous roles as an individual contributor, where her tasks were limited, she could go back and search for the required details without any trouble. But with the ever-increasing list of things to keep track of in her current role, the online version saves her a ton of time as she can search for the required details much more efficiently.

I feel like I'm being pulled in 100 directions. Even though I was a project manager earlier, and I felt like I was an extremely organized person, now I feel like I'm having to learn new ways to organize. As a manager, I feel like I need to take care

of not just my needs but everyone's needs to make sure I'm following up on everything. I'm a big list maker, and honestly, I just changed how I was doing it. I went to One Note versus when I used to be able to manage out of a notebook. I was old school, write things down. But too many things and I'm not going to remember. If it was my project and that's what I'm working on, you can go to your notes; you know exactly where they are. If it's eight people and multiple projects plus what your management and everyone needs, I have to go search and do different things, so I went to One Note. I'm a big Excel fan, always have been, so just set up some new filters and different things, different reports that I could set up so I could quickly get statuses and provide statuses.

Unlike the more challenging situations stated earlier, Lily also adapted to some of the changes associated with the transition without much difficulty. For instance, Lily didn't face much of a challenge shifting her focus from an engineering mindset to a managerial perspective. Lily was always inclined towards the management aspects of her work, even as an individual contributor. Moreover, she always identified herself as someone who can think big-picture, a capability that is integral to a managerial identity. Hence, assimilating into the managerial way of thinking and self-identifying wasn't very difficult.

I was always inclined definitely more towards the soft skills, broader management of projects. Sometimes it is nice to roll your sleeves up and dive in really heavy technically. But I've always been better at this[managerial] role. That's just always been the one that I have moved towards.

Although Lily was given the opportunity to take up informal leadership responsibilities in her prior roles, which immensely helped her prepare for this transition, she also made conscious efforts to seek out voluntary leadership roles. She frequently went above and beyond what was expected of her to take up initiatives that enabled process improvements in the company. She also often volunteered for activities within the company. Undoubtedly all such experiences prepared her for the new managerial role and contributed to her successful transition.

In addition to her prior experiences that helped prepare her for the transition, Lily is also trying to expand her skillset further to succeed in the job. One of the major skills that Lily has been working to improve is executive communication, which she believes all managers must learn. Although Lily was pretty good at communication, to begin with, post-transition, she soon realized that there were aspects to her communication that need polishing. Specifically, she realized the importance of effectively communicating technical details to the upper management and other stakeholders without losing the message and clarity of thought. And, is consistently working towards improving her skill even to this day after the transition.

It's actually more the soft skill, especially coming from a technical. I know, and I've even watched some of my peers struggle where they want to, and some of my team will struggle where they want to go down so deep into the details that they lose the message. Like I said, everyone should know that to whom you're communicating with, but we don't. It's something you definitely have to continue, and as a manager, you have to. It's your game at that point is communication. And I feel like I'm improving it every day, I learn something new.

Overall, Lily's transition into the managerial role has been fairly smooth. She is happy with her new role and is constantly thinking about developmental opportunities, and future training needs to improve herself as a manager. And, taking into account the role of her prior leadership experiences in catalyzing the transition experience, not surprisingly, Lily also advocates future engineers to seek out leadership opportunities whenever possible. In her own words, she offers the following piece of suggestion for engineers who are looking to transition into the managerial roles:

I think that they[engineers] should volunteer to drive a process. It's not always about taking a certain project; it's more looking at organization-wide items that you can assist with. I really see an issue with X. Can I grab a couple people, and we can brainstorm? That type of thing. And see if you can lead that type of an activity. Then communicate it out to the group. Because not only are you wanting to say, "Hey, I think we could do it better this way," you have to be able to communicate that properly to everyone and drive out that change. It kind of gets both sides of this, so you're leading it, and you're communicating it upward and downward. That's a good thing that would be for practice and just to improve your communication.

Specifically, she suggests engineers to take up initiatives for process improvements and volunteer to help with company-wide improvement efforts. She believes that in doing so, the engineers could gain not only visibility in the company but also improve their managerial abilities such as communication and leading people.

4.1.2.6 Individual Narrative 6: Seth

Seth has been with the same company for around 14 years, mostly involved with its [Function] group. After moving up a few ranks in the technical pathway as an individual contributor, Seth finally transitioned to a managerial role a year and a half ago in the same team. In his current role as a [Title], Seth is primarily responsible for ensuring multiple projects in the [Function] domain are delivered on time. And he does this with the help of 100 contractors and

full-time employees that report to him. Seth is also responsible for overseeing the growth and development of his employees as well.

Seth's transition into the managerial role has been mainly driven by his desire to move into the managerial pathway. He made an intentional choice to pivot his career this way. He recalls having cultivated the desire to become a manager a few years ago and has ever since wanted to move into this role. Reflecting on a hypothetical situation, Seth even suggests that he would still stick to the managerial pathway even if the company offered better growth opportunities in the technical career path. Due to this desire to become a manager complemented by his other prior experiences, Seth didn't find the transition very difficult. As Seth describes, "it [the transition] wasn't as tough as I thought it would probably could be." He also had great self-confidence, which, in turn, made the transition easier for him.

The ease in the transition experience also stems from his ability to embrace his newfound managerial identity. For instance, after transitioning into the managerial role, Seth quickly found his balance between his new role's leadership and technical aspects. While prior to the transition, Seth identified himself as a very technical person, moving into the new role, he quickly learned to accommodate the managerial aspects of his role as well. He began to perceive himself as a manager, a manager who is also aware of the technicalities of the project. Seth saw himself as someone who could not only oversee the technical aspects of the project but also delegate and lead people to get the work done. He consistently reiterated that his responsibility as a manager is to deliver projects rather than deep dive into the technical details. In sync with these shifts in his priorities, Seth also learned to quickly delegate work to his peers and ensure the project deliverables are met. This realization from the very get-go has helped Seth deal with the transition changes very quickly.

[Manager's] primary role is to ensure that we deliver projects on time. Be responsible for delivery. Responsible for guiding team, so all the day-to-day decision-making that we have to do on the nitty-gritty details and all those things are taken care by them. My primary responsibility is not to make those, but instead, delegate them to those SME's who can make it.

While Seth treaded some of the changes with ease, he did face some difficulty dealing with the increased emotional burden associated with the new role. As a manager, Seth realized that he needed to be composed and emotionally stable more so than when he was an individual contributor. Moreover, his team members now relied on him for emotional support. However, this change wasn't easy for him to cope with. In his earlier days of transition, he recalls losing his temper and

how that negatively affected his teams' morale. Consequently, he learned from his mistake, and he is trying his best to keep calm and composed.

I am supposed to be the role model for the rest of my team, so 100 - 120 people looking to you for guidance; at any moment, any point, you can't just have your emotions take control over that, whatever is the scenario. I mean, you just can't get animated over a call or when you talk to them. One instance, I wasn't calm, I wasn't composed, so I let go of my frustration because and as I said, it isn't in the best interest of me, it isn't in the best interest of the application.

Albeit these minor setbacks and changes, Seth adapted to the new role relatively quickly. He had a very steep learning curve in the first three months of his transition. In describing his preparations for the new role, Seth talks about seeking mentors to ask questions related to the new role. He was not hesitant in reaching out to his previous managers and other mentors for help during his initial days of transition.

During the transition, like during the initial weeks, I had someone guide me. My previous manager and mentor helped me with my current process, and I also sought out some advice from my one of my other mentors to understand what it would be like or how things would be different. So, I just had discussions, I probably would say an hour or two a week, but I had some conversations to understand what to expect and stuff like that.

Moreover, while “on the job”, Seth quickly grasped the need to develop new skills. Notably, in several instances, he references the need to learn people management skills. He contends that technical skills can only help someone in his role only to a certain extent. The rest, he says, is all people management.

I'd say technical skills are only for getting the day-to-day job. From a people management standpoint, I think the analytical skills help a lot. The ability to observe, research, and pay close attention to what their thought processes those help a lot. And that's the primary one.

A little over one and a half years into the role, Seth already feels like he has transitioned completely. Reflecting on his experiences and preparations for the role, Seth advises engineers looking to transition to talk to as many leaders as possible before the transition to know what they are getting into. He also advises them to improve their communication and people management skills.

4.1.2.7 Individual Narrative 7: Travis

After having worked at the company for close to 24 years in various roles, Travis finally transitioned into a managerial role from an individual contributor role just last year (at the time of this interview). In the first half of his career, he focused on hands-down technical developer roles and was quite content with it. Eventually, he realized how he missed interacting with people and moved into the product side, which offered him the opportunity to deal with people. Further, he even had a short stint with informal leadership roles. His passion for technology mainly drove Travis's career moves, and he chose roles where he could build on his technical expertise.

Travis's current transition is necessitated by the need within the company and the lack of a better career technical contributor pathway. Travis was quite content with his prior role as an individual contributor. And, in hindsight, he reflects how he would have continued with the role had the company offered him a better career growth opportunity within the technical pathway.

Yes, I would have [remained a technical contributor] because, I mean, there really wasn't any financial difference in just how the company pays. There really wasn't any financial difference. And, I liked the work that I was doing as an individual contributor because I've had opportunities to go to management levels before. But I just enjoy doing the work as supposed to managing people in doing all the work. So, in the past, I kind of had made a decision to stay as an individual contributor for that reason.

Despite his long tenure of work experience coupled with prior informal managerial/leadership experiences, Travis still struggled to cope with several of the changes associated with this transition. Specifically, as soon as he moved into the new role, he experienced changes that he wasn't quite prepared for. One such change that Travis had to deal with was learning to let go of the technical work. Due to a long history of doing technical work, Travis was so used to doing the more hands-on work that he often struggled with delegating the work. He also found it difficult to just let his team members figure out their own ways without getting too involved.

I'd say, you know, one of the challenges, at least me personally, is to just let it go and let my people do it the way that they want as supposed to, you know, how I might do it. The other difficulty for Travis was dealing with his self-confidence. During his initial days of transition, moving into the unknown managerial world from the technical domain seemed very daunting for him. He was nervous and doubted his abilities to handle the managerial workload.

However, after spending almost a year in the role, Travis seems to be much more confident in his shoes.

I would say that I feel more confident. At first, I struggled with not knowing what to do. And, I would say I'm much more confident in that. And I also feel much more confident in my load capacity - of what I believe I can handle, and prioritizing based on it's impact to [company]. So, I would say I'm much better at prioritizing and delegating, and knowing what to do myself.

Travis attributes his struggles to the lack of planning and preparedness for the transition. Having jumped right into the role without any formal training, Travis felt underprepared and was nervous. But over the last year, despite being thrown into the unknown waters, he tried to stay afloat by learning a “lot while on the job.” And this on the job learning is characterized by his necessity to survive and succeed.

I wouldn't say that the company has well formalized training programs to prepare someone to become a manager. And, in my case, just an opening came up, and it was pretty quick; you're just kind of thrown in. It's just a necessity because when you take a new role, there's just a whole lot to learn, and you're kind of drinking from a fire hose. And so, out of necessity, you got to figure out a prioritization method and a delegation method.

Although he didn't have any formal preparations for the role, he sought out mentors who, in turn, helped him with the transition. He often reached out to people both within and outside the company to ask them questions about the transition, the managerial role, etc.

I did actually seek out some mentors, just asking them tips, like really practical tips, and tools, and tricks that they use for managing their people, managing their time, managing their projects, to get some advice.

In navigating through such a transition, Travis emphasizes the need for him and other engineers to develop communication skills, including executive communication. Specifically, he talks about the need for engineers like him to communicate the technical details to the upper management crisply and concisely while ensuring they are engaged and understand the impact.

I think having crisp communication [is essential for the transition], if you're going to be communicating up to senior management, you got to be able to know the right level of detail to explain to them. I mean, management typically wants to know about the technical details of something. They just don't want to know everything, but just this impact of it like If you've got some options or we believe we can get it done in one week. Just high-level pros and cons, just being able to have crisp communication sometimes be a challenge for technical people, I have seen.

After spending a little over a year in the transition, Travis feels a lot more comfortable in his new role. He also feels more confident now than when he just moved into the role. Despite the lack of preparation for the role, Travis seems to be learning a lot on the job. He is also not afraid to learn and fail, which keeps him going in the current role. Thinking about his secret motto to survive the transition and the new role, Travis states, “So, sometimes it's just trying and failing and learning and getting better.” Reflecting on his learning experiences, Travis advises future engineering managers to always keep an eye out for leadership opportunities.

For example, in my role when I was just a heads-down programmer, all I had to do was just focus on my little world of technical development. But if you can, as much as possible, seek out opportunities to lead other people, even if you're an individual contributor, there could be project opportunities to take the lead on. I would tell them to seek that out.

Acknowledging his mistakes, he further steers engineers away from only doing technical activities early on in their careers. Instead, he encourages them to seek out opportunities to lead people and projects.

4.1.2.8 *Individual Narrative 8: Steve*

Steve has been with the company for the last 15 years, working in the same team but in different roles and capacities. Over the course, Steve, who started as an analyst in the team, quickly became a subject matter expert and a critical point of contact. From there, he moved into an informal supervisory role where he was primarily responsible for overseeing one part of a project. Finally, he moved into the role of the manager of the same team just over one year ago.

Steve’s transition into his new role has been smooth. His prior experiences as an informal supervisor for the same team provided him a purview of the managerial role even before his transition. He was quite familiar with the new role and expectations, making the transition easier for him. Although he was familiar with the new role and didn’t think it was a difficult transition, Steve wasn’t planning to move into the new role. He was quite happy in his prior role as a technical contributor. In hindsight, Steve thinks that he would have also considered a technical pathway had the company provided him better career opportunities in that stream. But since that wasn’t the case in the company, Steve transitioned into the managerial pathway when the opportunity was presented to him.

As Steve transitioned from a technical contributor to a managerial role, he noticed a significant change in the scale and type of responsibilities. Whereas, as a technical contributor, he was mainly responsible for the technical aspects of the work. As a manager, he is now additionally responsible for the people aspect of the job as well, apart from the technical oversight.

I used to have one set of responsibilities. Wherein my primary responsibilities were towards the application, making sure the application is robust and mission-critical and stays mission-critical and doesn't go down and is available. And we have the same stuff, make sales. That was my primary, but in it didn't evolve a lot from that. I'm still responsible for that. Now, in addition to that, I'm also responsible to make sure the people who are making this happen, the people who are working behind the scenes, are also taken care of.

In addition to managing people, as a manager, Steve was also required to manage and deliver the project end to end. This was in contrast to his previous role, where he was responsible for just overseeing one aspect of the project. These additional responsibilities mandated him to change the way he approached the job. He is primarily required to shift his mindset from just thinking about his individual task and its delivery to more broadly thinking about his team. Contrary to his prior role as a manager, Steve was responsible for ensuring the team delivered the projects efficiently and on time, leading to many dependencies on his team members. Hence, Steve experienced a cognitive shift wherein he not only had to focus on individual problem solving but also focus on his team members as well.

See, when I was an individual contributor, my only view or I had a tunnel view, right. I only had some small aspect of that problem in hand that I need to solve. I used to only solve for that, and I'm done, I did my job. I'm done. Whether the project is working and whether the project was successfully delivered or not didn't matter to me at that point because I did my job. Okay. I delivered what was asked from me. But when I get caught into this elite role, it's a little different in the sense that I'm not just responsible for my piece of the work; I'm also responsible for everything that my team is required to deliver.

Although Steve was now required to manage people in addition to managing technical aspects of the job, he felt quite prepared for it. Mainly, Steve credits this ease in transition to his prior supervisory experience. In the supervisory role, Steve was responsible for overseeing a small part of a technical project for which he needed to lead people to get the work done informally. This helped him get familiarized with managing the people aspect of his job. Reflecting on this prior experience, Steve feels grateful for his manager for giving him this opportunity as it catalyzed his managerial transition process.

Even as a technical supervisor, I was like a pseudo manager. I was taking care of a portion of the projects because my manager at that point gave me enough flexibility to take few things in my own hands and allowed me the flexibility to run a portion of that team I was responsible for. So I'm really, really thankful for that help that she provided at that time. That kind of helped me, you know, get into this role or transition into this role much easier. It made it a lot easier for me because I was almost there.

In addition to the informal leadership opportunity, Steve also received good mentorship, which further helped him with the transition. Steve made a conscious effort to seek out mentors who further helped him prepare for the managerial role.

I think I should be thankful to the seniors in my team. Okay. They've mentored me well. They provided me all the support that was needed; whenever I needed any help from my seniors, I went to them, and they've always been there for me.

Apart from the prior preparatory work, Steve also picked up new skills on the job that helped him navigate the high-pressure situations of his current role. For example, very early on in the transition, Steve identified the need for him to develop more patience to manage stressful situations with ease. Steve realizes that he needs to be reliable for his team members and remain calm during crisis moments to boost their confidence. These skillsets and capabilities greatly aided Steve in navigating some of the challenges faced by the new role.

So as a manager, you got to have patience. There will be times when your nerves will be tested, and you need to handle yourself under pressure. You shouldn't be crumbling when your team relies on you. And if you're strong, the team will be able to keep their cool and, you know, deliver.

Overall, Steve's transition has been "extremely smooth." Owing to his prior experiences and preparation, Steve has efficiently managed to navigate the new role's changes and challenges. Reminiscing on his journey, Steve suggests future engineers also follow a similar path for an easy transition into managerial roles. He advocates engineers to seek various leadership and mentoring opportunities as he believes it would propel them into management quicker and also help them grow in their careers faster.

Yeah, I strongly recommend everybody in my team to go through the same process that I opted for, avail all of the opportunities that are there in the company. Whenever you get an opportunity to get signed up for those leadership programs, and training programs to enhance your skills, I always encourage them to go take those because these are the things that help you grow your career.

Well into his second year of transition, Steve still feels like he is not “100% fully into the role” yet. He still thinks he has a lot to learn and wants to keep improving and enhancing his managerial skills.

4.1.2.9 Individual Narrative 9: Andy

Having received a bachelor’s and master’s degree in Industrial Engineering, Andy has always been inclined towards the operations and optimization side of the business world. Soon after graduation, Andy started as a technical analyst in the company and slowly moved up the ranks to become a manager of a large development team. Having always wanted to become a manager, Andy, even as a technical contributor, consistently sought out roles to develop his managerial skills and eventually made an intentional choice to transition into the current managerial role. Currently, in his second year as a manager, Andy now manages a portfolio of 6 projects and a team of 65 engineers.

Despite the prior experiences in informal leadership roles, Andy experienced several personal changes during the initial months of the transition, which were quite challenging to navigate. One such change was an increase in the scale of responsibilities. As a manager, Andy was now directly responsible for coaching and managing over 65 employees. This was daunting initially as he didn’t gain much exposure to these managerial aspects of the job in his earlier roles.

Well, so, one thing which took me a couple of months to three months to adjust was the scale of responsibilities. Because once I had the formal title, I was directly responsible for so many employees. I now needed to get their performances and evaluations, you know, for your growth and whatnot. That's one big change that happened when I became a manager.

Due to the increased scale of responsibilities, Andy also found it quite challenging to spend as much time and attention doing hands-on work on the technical tasks. In contrast to merely delivering a single technical task, Andy was now responsible for delivering multiple projects, making it impossible for him to go into detail with every single technical task. This, in turn, prompted him to shift his focus from individual tasks to more project and team-based deliveries whilst learning to delegate the technical tasks to his engineers. And in doing so, he learned the importance of letting go of the need to deep dive into the technical tasks and rely more on delegation, which helped him oversee the projects more effectively.

The other thing was, earlier, I was more hands-on and having a technical background, I was always in the middle of things. But, with a larger portfolio now, that became more challenging to spend and specifically devote that level of attention to every single thing. To every single technical detail. I'm identifying other people who can take over that responsibility, the technical side of things and, I become more of a true manager, where I can groom people for the future.

While some of these changes associated with the transition were challenging for Andy, there were a few others that he faced at the beginning that were rather easy for him to navigate. One such change included a change in work-life balance. With increased workload and demands, Andy was required to spend more hours at work, which affected his work-life balance a bit but did not pose any challenge for him. Mainly, Andy was so determined to become a manager; he was very much prepared to take on additional responsibilities. In fact, the work-life balance changes were in alignment with his expectations from the role, making it easier for him to accept the change.

Honestly speaking, as I mentioned, I was wired to be on this career path, and I do know that as you grow in your career, there's going to be more responsibilities and more demands. So even though I would say the work-life balance has probably tilted a little bit towards more work, but that's not something I wasn't expecting.

In addition, Andy also experienced a few positive changes associated with the transition that helped him further ease into the new role. For example, Andy experienced increased visibility and recognition for his work due to the change in title to a manager. His work was appreciated and acknowledged more so than when he was just an individual contributor.

The change, the way I would describe it is that, when you have a formal position or title, it makes you more visible in the organization. Even though I was doing a lot of things that I am doing right now and is similar to what I have done earlier, there still was a different person who was officially the manager, right? Now, people know that this is the team led by so-and-so person. So there's more visibility and more appreciation and more acknowledgment. In that regard, the relationship has changed with my peers and my team members. And so, I would describe it as impacting both socially and professionally.

Although Andy faced a few hiccups in his transition to a managerial role initially, he quickly adapted to the new role. This was mainly possible because of his prior preparations for the managerial role. Having a strong desire to become a manager from a very early stage, Andy has seized all opportunities possible to hone his leadership skills as an individual contributor. From seeking mentors for guidance and support to enrolling in leadership courses at Ivy League schools

to participating in a leadership program offered by the company, Andy, over the years, sought out several learning experiences that have prepared him for the current role.

Three or four years ago, there's a program called the [OLDP]. I went through it, and I had a senior VP in the network who was my mentor for one year in the program. That was in [year], I believe, and that was a good learning experience. Especially now, when you have a mentorship at high level. So that helped a lot. And then I also went to [Ivy League] for a leadership course. This is all before I got the formal title. I was preparing myself for where I am now and where I'm going to be eventually. So, I have been working on these things.

Apart from these, Andy always moved forward with a “strong ambition and desire to keep improving and keep growing.” He consistently upskilled himself by reading many leadership books and reading a lot about “what other leaders at other companies were doing.” This also helped him grow as a leader in his current role. He was able to “expand his knowledge” and “have an understanding of the bigger picture.”

For any engineer looking to transition into an engineering managerial role, Andy suggests honing their people skills and strategic thinking more so than anything else. He acknowledges that an engineering manager is often tasked with leading teams of people from diverse technical and professional backgrounds; making it very critical to be trained to lead people from diverse backgrounds in a harmonious way to improve the teams' efficiency.

I would say, once you definitely decide on going into management, look to go through whatever is available in terms of courses for people skill; how do we manage and deal with people with diverse backgrounds? Because when you are leading or managing a team, the individuals will be from different technical and professional and other backgrounds. They all have to come together. So, that training to improve people skill I think is important for any manager and secondly to know a bit of strategic thinking is also required. How one gets, I mean, I don't know if there would be courses at [company] or not, but, again, I did my part of seeking out those things. Expanding on my skill set, but I think that's required - strategic thinking and expanding your skills for dealing with a diverse group of people.

While he is successfully settling into his first managerial role, Andy strives to keep growing as a leader and wishes to seek more growth opportunities. He is already considering the next transition. He wishes to move into senior management and is already working towards that goal. He is continually making progress on that front by reading autobiographies and other leadership books, interacting with other senior leaders in and outside of the companies, and exploring

opportunities to get an (MBA) degree all of which he believes would help him move into the next roles.

4.1.2.10 Individual Narrative 10: Pete

Pete has been working with the company for over 20 years in several technical contributor roles before he finally transitioned into a technical manager's role. Before his professional career, Pete was trained extensively as an engineer with a bachelor's degree in Mechanical engineering and a dual Masters' in Math and Computer Science engineering. Furthermore, before his current transition, he also worked towards a part-time Master's in Business Administration (MBA) degree to gain some credibility for moving into the managerial pathway.

Although Pete, in the initial years of his career, was inclined towards a career in the core technical and engineering work direction, within a few years, he was challenged by the lack of opportunities to grow further within the technical pathway and switched over to the managerial pathway. His motivation to become a technical manager was partly driven by his fear of a layoff which he supposed would happen had he continued down the sole technical work path. This was prompted by an on-going offshoring and layoff situation in the company at the time. He presumed that there would be a higher chance of eventual offshoring of his work if he didn't update and expand his skill set. Around the time, he intentionally decided to switch over to the managerial pathway to be in a better position and to be a more valuable and non-replaceable resource to the company. In line with this new career move, to bolster his credibility for the switch, he further decided to update his managerial skill-set by pursuing a Project Management certification (PMP) and an MBA degree.

[That year] the company off-shored a lot of technical jobs. Which gave me a pause in direction. And at the same time they opened up, I think it was called the [process improvement team] or something of that sort. And so I swapped over to that [managerial pathway] to change my skills, not wanting to be in the group that was targeted to be offshored or off-boarded or whatever you want to call that. And so that's where my path deviated a little bit from being technical to being more technical program manager.

In his current role as a technical manager, Pete is directly responsible for leading a team of 16 engineers over a wide range of products. Not surprisingly, his major responsibilities entail more managerial tasks than sole technical tasks. In describing his current role duties, Pete affirms the

managerial aspects of his work as he summarizes his role responsibilities into three major managerial buckets. These include: 1) managing resources and doing the administrative tasks; 2) ensuring the team accomplishes their assigned tasks; and 3) aligning his team's work with the broader vision of the company.

So I would classify them [role responsibilities] into three pieces. One is the management of resources and doing the managerial administrative stuff. Which would be making sure they do their performances, make their time entries, PTOs or they've stopped. That has very little technical. The second thing is monitoring the teams on making sure that the tasks that they're assigned get accomplished in time. i.e. That if they're assigned any development activity. I know how much is completed, if they are running into any issues, whether I need to step in and escalate those issues, stuff like that. Then the third one is to get the team to do the overall solution, the solution in the correct implementation or architecture that's designed by the wider company.

Coming from a strong engineering background, transitioning into a managerial role was rather “difficult” for Pete. Mainly, his prior training and experiences as a technical contributor did not align with the current managerial role's needs. For example, the current role required him to manage and lead people. However, Pete initially found it challenging as he wasn't aware of many ways of motivating his team members to get the work done. He also suggests that non-technical managers would have better tools to managing and motivating team members as opposed to technical people. As a technical contributor, Pete wasn't necessarily trained for the people aspect of his new role. This challenged him a bit during the transition.

Motivating resources is probably a tough one. When you're a technical person, you typically don't think about those things- on how to get the team motivated and get the team-building stuff, and to do those sorts of things. So, that's also a challenge to come up with those activities. I think if you are a non-technical person, you have those crafty ideas for managing people.

In addition, one of the other significant challenging aspects of the transition for him was moving beyond the traditional engineering “black and white” cognitive way of processing and doing work and move towards understanding and navigating grey aspects of managerial work. For instance, as a technical contributor, Pete had a well-defined solution to deliver to a well-defined task. However, as a manager, his decisions are now constrained by several stakeholders involved in the process, including his team-mates, senior leadership, and other co-dependent departments.

To me, the most difficult part of the transition is dealing with the grey areas of management. So I look at my background as an engineer and I'm more of a black and white guy. It's either right or it's either wrong, there is no middle ground, there's

no gray area. I think when you go up to managerial places, there is a right and wrong and there's also a big gray area in between that you get to manage. And I think that's the difficult part, the management of that gray area and the decision making process involved over there.

Apart from dealing with shifts in mindset from engineering to management, Pete also experiences difficulties navigating the social and relational aspects of his work-life. Having spent considerable time in the company before the transition, Pete forged several friendly relationships with his colleagues over the years. However, after transitioning into the managerial role, Pete found it challenging to maintain those relations as he was now officially managing some of these old colleagues and their work.

So the relationships that I have built-in those 12 years was more of a friend than a colleague type. When you switch onto manager role, it becomes difficult to maintain the friendship role versus the manager role because at some point you got to tell them to work too or what they've done is wrong and you got to do the performance evaluations and all that sort of stuff. So to me that was the tricky part of how I would go about doing it.

Over the course of the transition, Pete has also adjusted to the new role by internalizing an identity shift. He acknowledges moving away from self-identifying as a technical person and instead embraces his new identity as a manager. This in part, stems from the low emphasis and need for purely technical work in his current role.

Yes, there definitely has been a shift in the way I identify myself. If you asked me this question three years back, I would say I'm definitely technical. I was in the weeds doing technical stuff, architectural stuff, and all that. I don't do that anymore. So I would say maybe 70% managerial.

However, to deal with some of the transition challenges, Pete made some adjustments to his social and professional self. One of the significant adjustments he made during the transition was learning to “toughen up” and “get used to the emotional problems.” Due to the emotional burden of dealing and managing several people, Pete learned on the job a few ways to navigate the social relations and emotions associated with leading a team. Similarly, he has also made efforts to “try and keep a gap between friendship and work, which [he] did not do in the past. “

For Pete, some changes associated with the transition were challenging to navigate. However, some of his prior formal education and training helped him with the transition. His prior technical work experience and MBA experience laid the foundation for his technical and financial skills, respectively, which helped him immensely in the managerial role. In addition, Pete also

went through a company organized leadership program where he found mentors that further guided him through the transition. Luckily for Pete, these mentors have had similar backgrounds and experiences as Pete and guided him more specifically with his problems and challenges.

In terms of specific competencies and strategies, Pete emphasizes communication and problem solving as critical for his transition. Mainly, his ability to listen to a broad range of stakeholder perspectives and picking up “useful bits and pieces of information” personally helped him a lot during the transition. He further asserts that engineers often struggle with “the people side of the house” and have a real need to pick up these “soft-skills to transition into the managerial role successfully.

Reflecting on his journey, Pete strongly advises future engineers to consider the managerial pathway only if they have a real interest in the “people and managerial side of the house.” Based on his experiences, he believes that engineers like him often transition into the managerial pathway for the wrong reasons, such as hoping to get a career boost but with no real interest in being a manager, which causes a lot of difficulty in the transition. However, for those considering the managerial path, he suggests seeking out a “job-shadowing experience” to some degree before deciding to switch to the managerial role.

Although Pete’s initial years of transition has been characterized by some level of difficulty, third year into the transition, he now feels fully onboarded into his new role and even considers himself a true manager now. He has come to a point where he thinks doing technical work isn’t an ideal fit for him anymore and wishes to continue in the managerial pathway moving forward.

4.1.2.11 Individual Narrative 11: Scott

Scott has a major in Computer Science and Engineering and considers himself as a very technical person. His interests are very technology and engineering-driven, and is constantly trying to update himself with new technological advancements in his domain. In his 14-year career span, Scott has held various positions in different areas of computer engineering as an individual contributor first and then as an informal technical lead and now as a manager. In his current role as a manager of [function], Scott is responsible for managing a team of around 18 people.

For Scott, the transition into the managerial role hasn’t been a “sudden shift.” Even before this transition into the managerial role, he started taking on additional responsibilities as he moved from being an individual contributor to a technical team lead role. Although Scott did not manage

any person directly as a technical lead and was only responsible for overseeing a few components of the projects, the experience of taking on additional responsibilities helped him prepare for the current managerial role and the transition. As a technical lead where he was a part of a high stakes project, Scott often got exposure to the senior leadership who were closely following his work. This experience helped him closely watch and learn from the senior leaders as to what management entails. Moreover, as he was intentionally working towards becoming a manager for a long time now, the shift seems “not very sudden and big.”

Due to his prior exposure to some aspects of management as a technical lead, Scott doesn't perceive to have experienced many major changes during the transition. For example, he doesn't recognize any shifts in the way he perceives himself both before and after the transition. As he notes, “Me personally, I still believe, I don't see myself different than previously.” This could primarily be because how he still considers himself a technical person both in the new and old roles. Even in his current role as a manager, he thinks of himself as a technical person first. He even suggests that the technical skills are more critical for the managerial role and that “anyone could pick up the people skills required for the managerial job.” However, in contrast, he does acknowledge that his peers “see me[him] as a manager, both at office and outside of work now”. Moreover, in another instance, contrary to his initial perceptions of personal changes, Scott talks about the difficulty and importance of acquiring people skills in addition to the technical skills as a manager.

That was the one that made me shift in terms of what is really needed, not just the technology aspect of it, but people skills, social skills. And that's when I started working through some of it.

Similarly, in a few instances, Scott also describes difficulties in maintaining the work-life balance in the managerial role. He specifically attributes this change to the work demands of the managerial role. Mainly, moving from not being “fully 100% responsible” for any project deliveries to ensuring all his team's processes and projects are running smoothly, he has an increased workload and responsibility, thereby impacting his work-life balance.

In addition to the prior exposure and experiences as technical lead, Scott also intentionally sought out two mentors who helped him ease into the managerial role. He also explicitly networked with senior leaders across various departments before the transition to better understand what a managerial role entails and what to expect from it.

Yeah, I did a few things. Mentorship I'd say. I keep a close eye on some of the leaders at [company] and even outside. I reached out to people, to different managers, different directors personally and, even reached out to the [Chief of Engineering] back then and he'd tell me what they do and all of that stuff. And, they all kind of helped me understand what to expect.

While the transition process has been pretty smooth for Scott, he is consistently learning to become a more effective manager. For example, Scott emphasizes the need for organizational skills and emotional capabilities as critical for a managerial role and is developing those.

I'd say, organization skill is something I would say that I still need to work on myself personally because a lot of technology folks are not that organized. So, organization aspects of trying to deal with things which takes priority.

In terms of underscoring the need for managers to develop emotional capabilities, Scott talks about the need to cater to his team member's needs and problems. As Scott contends:

What works [for an effective manager] is at least having the ability to see that somebody has a problem, making sure you make time for them and to go work with them. Helping the team and considering the team as not an individual, it's a group of people with specific needs.

Despite some of his earlier notions that technical skills and capabilities are most critical for a managerial role, Scott later acknowledges that it's the people skills that are essential, more so than the technical skills, for the managerial role. Moreover, he doesn't hold back in advising engineers that technical skills and technology are easier to pick up and that they need to be focusing more on the business side of things as future managers. He further states:

I advise technology people two things - Computers are easy to work with. Even if you think it's not. And, technology, it's just technology. It can be done any way you want it. So don't worry about that aspect of it. You've got to understand like how you're helping solve the bigger picture problem and how do you understand the problem statement before you provide a technology solution? So yeah, I can go from point A to point B, anyway I want, but try to stand with what the business is trying to solve for, or whoever, or what you're trying to build the solution for? What do they want?

Overall, Scott's transition has been pretty smooth so far. Notably, his prior experiences have played a significant role in making the process easier for him. Though Scott didn't face many difficulties transitioning into the managerial role, he did learn over the course of transition that the people skills and big-picture thinking are as critical, if not more critical than the technical skills to be an effective manager and is consistently working towards developing them.

4.1.2.12 Individual Narrative 12: Leo

Leo started his career almost 24 years ago with company as a pre-college intern and has stayed with the company ever since. Throughout his long career, he has held several positions in the [Engineering Function] as a technical contributor before deciding to move into a managerial role.

Leo's transition into the managerial role has "not been very spontaneous or immediate." Although Leo did quite well for himself and proved his worth as a contributor over the span of his long career, he has had a few trigger points in the last few years, which finally led him to take up the managerial position. Mainly, a senior leader at the company provoked Leo to think if he was really content with the role. This questioning pushed him "to take upon more significant responsibilities and grow as a leader". In fact, he believed that continuing in the technical pathway wouldn't be as challenging for him anymore. Besides, Leo was also felt constrained by the lack of challenges in his current role. He felt his growth being limited in the technical role. And these epiphanies led Leo to transition into the managerial role after 18 years of working as a technical contributor.

As he braced for transition, he also experienced several personal changes that were difficult to navigate, at least in the initial stages. For example, he experienced a major shift in his work-life balance. Whereas, as an individual contributor, he never had to worry about any pressing issues that would require him to work late hours. As a manager, he "wouldn't be surprised to stay up till mid-night and deal with critical project deliveries and issues." In describing the impact of the new role on his work-life balance, Leo quips, "I would argue that being a director is a lifestyle and not a choice, I think that's the running joke." However, Leo was intentional not to let work impact his work-life balance. Specifically, over the last year or so, he learned to set boundaries with his colleagues. He set up a "hard policy" for his team wherein he wouldn't attend to office-related calls over the weekends, holidays, or even late hours unless it is an absolute emergency.

I often say this to my colleagues where I have to apologize and say, hey look, just so you know, I have kind of a hard policy, which is I will check my phone on the email side once a day on Saturday and Sunday. I'm only available, if you really need me, you really, really need me.

In addition, Leo also continues to experience social and relational changes in how people behave and perceive him in his new role. This change is somewhat surprising and unexpected for Leo. Although Leo proved his worth as a technical contributor, he believes that most people don't

give credit to his prior work as much as they do for his current managerial contributions. He is more noticed for his work because of the managerial tag, which carries a certain sense of power and attention that a contributor title lacks.

I will tell you when I'm in the room now, the weirdest part is I'm not invisible. But when I had my job before, you can literally say, hey look, this guy actually holds over a hundred patents as an individual contributor. I do. And I am one of the foremost experts in blah, blah, blah. And you can pick a couple of subjects and that would be accurate if I still walked into a room yet they only care that I am a manager here. I'm like wow, you can be like a Nobel laureate, and no one would notice. But, if you're some sort of low-level director or a managerial, people notice and credit you so much more.

In addition, Leo is also learning to deal with the additional emotional burden of managing a team. As a manager, he is now thrown into more stressful situations than what he had experienced earlier. Particularly in times of crisis, he feels responsible for his entire team's well-being, which is in contrast to caring for his individual self as a technical contributor. This further puts additional burden and stress on him. But, to serve his team effectively, Leo is “learning to stay calmer and stronger for [his] team.” He also realized the importance of displaying emotional intelligence as a manager and is striving to develop those skills and capabilities.

I'm exercising more of the emotional skills in management around, staying calm. I used to joke that I was never the calm one, but I would also say as a manager when you see things melting down, you want to stay calmer for the team. As a manager, I am put in very stressful situations and also have to deal with crisis situations like recently I was in charge of crisis management during Katrina hurricane. It's very stressful.

In addition to the emotional skills, Leo also learned to be an effective listener, which he thinks is a critical skill for a manager. He talks about learning the importance of these skills through “constant exposure to stressful situations”. Interestingly, before the transition, Leo did not actively pursue to identify and develop any managerial skills but once in the new role, he made deliberate attempts at evaluating his skill gaps every so often. Throughout the transition, Leo has kept an open mind and has shown awareness in the skills and competencies that he needs to be picking up and polishing to be an effective manager.

Although Leo has over two decades of experience within the same company, transitioning into a managerial role is still very new and challenging. This speaks to the wide disparity in the functioning of the two roles, namely the technical contributor and the managerial role. And, close to one year into transition, Leo still doesn't feel like he has transitioned completely but believes

constant exposure and dealing with various unexpected managerial situations so far has helped him prepare for the challenges ahead.

4.1.2.13 Individual Narrative 13: Kevin

Kevin started as a field engineer at the company and has since moved up the technical pathway as a technical contributor before taking up the managerial role. Primarily, he moved from being a field engineer to an architect and to a technical lead before finally deciding to move into a manager's role. As a technical lead, although he didn't have any direct reports, he did have exposure to dotted line, informal responsibilities of leading a few aspects of their team's technical projects. This prior experience of informal management has made the transition "very easy" for him. Even before the transition, he was quite prepared for the people management aspect of the new managerial role.

When I was a team lead, there was no direct reporting to me. It was all dotted to me. It was not necessarily the people that were dotted into me, but parts of the function dotted into me. Since I had that background of functions dotted, I became a manager. It was very easy for me to handle both from a functionality standpoint and also from a people management standpoint.

In the current role, Kevin is mainly responsible for driving accountability for the projects and functions assigned to him. He oversees a team of 8 people and his central role as a manager is to "drive accountability through delegation through these 8 people and making sure that the teams are accountable for what they do. It's a major function that I have".

Although his prior experiences as a technical lead prepared him quite well for the transition, Kevin still experienced a few unforeseen changes as a part of the transition. One such change is a cognitive shift in his field of view. As an individual contributor, he was only responsible for thinking about his particular delivery across a single function or a part of the project. As a manager, he has to broaden his focus and start thinking about his work's implications across the team and across the different project deliverables.

I definitely think there's a change in the cognitive zone. To be specific, for example, when you're talking, an individual contributor looks at it from a standpoint of his deliverable, his field of view and is going to be concentrated only across his own task in the project and the delivery that he has on hand. But, after you become a manager, you're looking at a much holistic view. And if you're talking to another function, you look at what implications that your conversation would have on all the other deliverables that are on the horizon.

He also dealt with a minor shift in self-identity. While being a technical person has always been an integral part of how he identified himself, as a manager, he now considers himself more of a “technical manager,” a person who exhibits managerial traits while carrying along the engineering way of thinking. In fact, he believes that how he identifies himself now changes based on the situation. For example, while at times he manifests himself as a manager “driving accountability and leading his team members,” at other times, he goes “into the weeds and thinks of solving a problem and delivering the project from solely engineering standpoint.”

Since Kevin has always set himself up for the managerial role, he also actively sought out mentoring opportunities with senior leaders to guide him and help him understand what is expected of managers and leaders. These interactions with the senior leader mentors have also inspired him and prepared him to do better as a manager.

I always looked at these mentors, I closely followed how they tackle work. And that kind of helped me understand what I would be, what I should be doing when I become them in few years from now.

Kevin believes that to succeed in a managerial role, engineers should seek opportunities to connect and interact with senior leaders. He also thinks they need to first and foremost identify the “soft skills that they would need for the role”. He suggests that engineers should be focusing on developing such social skills more so than the technical skill-set.

So the technical skill you'll always have it and you probably know more than your manager, because you're more close to the technical aspect of a particular problem, but where you probably feel the gap after becoming a manager is the development of that soft skill. Picking up those soft skills before you become or before you transition to a manager would definitely help you after you become a manager.

Overall, Kevin’s transition into the managerial role has been smooth and easy so far. Although his prior experiences certainly helped him ease through some of the changes and challenges inherent to the transition, he is still trying to fully onboard into the role. He is still trying to develop new job skills and improve himself as a manager. While he was barely managing to stay afloat in the first year of the transition, he started picking up more managerial responsibilities now and is confident of “handling any curveballs thrown at him.”

4.1.2.14 Individual Narrative 14: Usher

Usher has been working with the company for over 20 years now, mainly as a technical contributor in the [function] team. Usher moved up the ranks in the technical pathway till the last possible level as an individual contributor before he finally moved into a managerial role two years ago. In his prior role, despite being a technical contributor, Usher had the opportunity to work with different teams and functions. He was also responsible for building consensus among his teammates to develop technical solutions for their projects. Some of these experiences have immensely helped him transition into the formal managerial role. In his current role, he manages around 100 people, including both full-time employees and contract workers.

For Usher, the transition to the managerial role has been pretty smooth. Since he moved into the new role within the same team, he felt at ease knowing that he would be leading his peers whom he had known for ages. He was familiar with the team's functioning and had a good working knowledge of the technical work they do, both of which aided him in the transition process as well.

[The transition] was kind of smooth in a way for me. Because I didn't have to learn much about the people. I already knew them from before. You know, many aspects of my team, what are the things that each individual likes and what they don't like, what they're good at and not good at or with anything to improve on. So that kind of helped, and it did make that transition smoother.

While moving into the same team's managerial role had a few benefits, it also came with its own set of drawbacks. Mainly, Usher had to navigate some social and relational changes and difficulties due to the transition within the same team. He noticed changes in office relationships and social aspects of his work life. For example, as a manager, Usher can no longer afford to have conversations around pay structure or salary with his colleagues, which wasn't quite the case earlier. He also makes conscious efforts to not indulge in certain managerial level discussions with his peers as they might lead to a conflict of interest for him.

So previously I had folks sitting in my cubicle, on my desk talking about everything, including these structures and bonuses and things like that. I can't expect them to do that anymore because now the feedback I give or the discussions I participate in, I need to always keep in mind that now that I am in a different role where I'm aware of some of the things about other coworkers that these folks don't know of. Like I can't indulge in some of those discussions.

In addition to the social changes, Usher also experienced shifts in some cognitive aspects, including how he thought about work. As a manager, Usher can no longer afford to go into the

weeds of all the technical work as he used to when he was just a contributor. Since the responsibilities have multiplied, he realized the need to shift focus from individual task deliveries to a more holistic view of project deliverables across teams. However, Usher has slowly learned ways to adapt to these changes. Specifically, he has learned to trust and delegate work to his employees. He relies on his team members to focus on the individual tasks leaving him room to focus on the holistic project deliveries. To deal with the additional responsibilities, he also learned to be better at organization skills. For example, he learned to journal all critical pieces of information that could be retrieved as needed. This helps him cope with the increased cognitive load associated with the new role.

Usher's transition into the managerial role has been pretty smooth and easy, barring a few challenges. While transitioning into the managerial role within the same team helped him to a certain extent, he also got a lot of help from his mentor. He found a great mentor through the company [OLDP] program, who guided him throughout the transition. He also sought mentorship from his previous manager, which further helped him "get up to speed on a lot of things."

So the year before I became a manager, I had a mentor from the [function] team who is also a director. That helped me with a lot of questions I have on about the transition on how did you do that and what are the things you face. And so that was really helpful for me.

In addition to the planned preparations prior to the role, Usher also learned a lot about managing people while on the new job. He realized that people skills are as critical to a managerial role as are technical capabilities. He has since worked towards building those skills, skills including listening, communication, and consensus-building. This realization stemmed from some of his initial experiences as a manager. For example, in one instance, Usher needed his team members to complete a certain task by the end of the week for which sent out a standard note to everyone. However, he soon realized that "some took it seriously and started doing it [the task], and some did not respond at all." This made him see that people respond to notes and feedback differently and that he needed to develop the people skills to cater to the individual needs and styles of his team members. In other instances, he realized that to be a great leader, one needs to listen and build consensus. He learned that people (both his direct reports and upper management) start to "respect the manager only if they are able to listen to various opinions and build a consensus among the different stakeholders." This learning stemmed from a prior experience where he pushed down the "right way to approach a problem" without hearing what his teammates had to

say. Although it saved them some time during the discussions, he couldn't bring the team together and engage them as effectively to complete the task.

For those engineers looking to make it to the managerial pathway, Usher suggests 1) participating in company-sponsored mentorship and leadership programs, 2) trying to seek out opportunities where they can interact with other teams/functions, 3) making a deliberate attempt to showcase communication and leadership skills wherever possible. And, with just over two years into the transition, Usher is completely settled and on-boarded into the role. In fact, Usher did such a great job as a manager, he is already being considered for the next promotion at the time of the interview.

4.1.2.15 Individual Narrative 15: Samuel

Samuel has always been fascinated by technology, and this fascination has led him down a career in the field of computer engineering and technology. After receiving both his bachelor's and master's in Computer Science and Engineering, Samuel joined the company 17 years ago. At the company, he held various roles as a technical contributor before moving into the managerial role 2 years ago. Despite his strong desire to continue in the technical pathway, Samuel had to make an intentional choice to move into the managerial pathway for better future career prospects. He realized that he had hit the ceiling in the technical pathway and that any future growth plans would require him to move into a hybrid technical managerial role. Hence, albeit a little hesitation, he did move into a managerial role when the right opportunity presented itself.

I was already at the highest level as an individual contributor, I will have to stay there or I will have to pick a different path, a managerial path, if I want a growth. I thought about it and that's when I decided, okay, now I need to change this little bit and look into these managerial opportunities. After that, I talked to my senior leadership and I asked them for their advice. I told them that I want to be a technical guy and I want a career growth. They said, it's not really possible and that I had to move into a managerial pathway and choose technical managerial roles so I could still be closer to the technical work.

Once he became the manager, Samuel struggled to navigate between the complex technical and managerial worlds of his job. He wasn't sure if his employees needed him to be the technical expert or if they just wanted him to be their manager overseeing their technical work. Moreover, since his previous managers were not technical people, he did not have anyone to look up to either. This was a bit of a struggle for Samuel. However, he soon learned a way that seemed to

work with his team. Specifically, he started to distance himself from his technical self when it came to the everyday hands-on technical work that his team was working on. He did so by assuring them that he wouldn't step in their day to day technical tasks or tell them how to do a task. And, he focused on the managerial aspects of only overseeing the day-day activities. However, he still manages to bring elements of his technical self by brainstorming the technical ideas with his team, albeit at a much higher level. This helps him incorporate pieces of both technical and managerial aspects into his role as a technical manager.

I actually said I'm not touching systems, I'm not even going to login, I'm not requesting even the access to the system, that's how I started. I was like, okay, I will do more of the high level work, I will not login to the systems, I will not do any coding or anything as such. But, I have an idea of how I want this to work, how this, how I want this to function. I'll give you my idea and you guys make this happen. And you tell me how you want to do this.

Although Samuel doesn't seem to notice any other changes associated with the transition explicitly, he provides a few examples that speak of the difficulties he faces as a manager. These include difficulties with the people aspect of his job, which is unique to the managerial role. For instance, he talks about difficulty conversing with his colleagues about specific sensitive topics such as pay structure, salaries, layoffs, bonuses, etc. He realizes that in contrast to when he was an individual contributor where he would complain to his manager, the onus is now on him to appease his employees when they come to him with all the issues. He also needs to deal with the emotional burden of taking care of his employees and their well-being.

The difficult one is obviously, as a manager how to suddenly deal with some items like um, like dealing with annual salary raises, dealing with people with different personalities, to be good to people, to take care of them etc. So dealing with those people and making sure they understand and work as a team. And for example, if there are no raises some year, you have to deal with that, right? People would be expecting, even myself, I'd be expecting some raise, probably every year, if I don't get that I will be upset. And I expressed that to my boss in the previous years when I was a contributor, but now I will have to deal with same situation as a manager. So, those are really the unpleasant situations.

In other instances, he talks about needing to build on the people skills. Although he is still learning effective ways of dealing with people, particularly dealing with conflict and motivating his team, Samuel acknowledges the importance of these aspects for any managerial role. He is also learning to embrace the "admin aspects of the managerial work," aspects such as year-end employee reviews, addressing employee concerns, providing feedback, etc. Despite his strong

dislike towards these managerial and administrative elements, Samuel has been trying to accept them as critical duties of a managerial role.

Being a manager, it's not technical. Probably as an individual contributor, you always hated doing that [admin] work, now in addition to doing your own work you have to make sure your team is doing all of those year-end reviews. You have to give them a chance and give them the feedback. So those are some items when you become a manager that you will not like, but those are important.

Although he didn't have any formal training and preparation for the managerial role and the transition, Samuel has been learning a lot, be it on the job or through his mentors or observing senior leaders at work. Even before the transition, Samuel has been watching, interacting, and observing senior leaders to learn about management and people management. Mainly, he wanted to understand:

How they are approaching the problems and how they are dealing with the conflicts and also how they think out of the box, how to provide solutions for business problems or business requirements. How they come up with this out of the box thinking and how they convincingly say no to their employee requests when needed.

These lessons have helped him deal with the “people aspects of the new role.” Also, he specifically sought out a mentor to help him through the difficulties and challenges he faces in the new role. In describing his strategy for dealing with issues concerning people management, he says, “I don't know just yet, I'm still learning, and I'm still I can try to improve in that people skills and soft skills area. My boss is my mentor in that he helps me with that”.

Consistent with his own approach to dealing with the difficulties of the transition, Samuel advises future engineers to seek out mentors and ask for help. In fact, he sees “no shame for engineers to ask and seek help or even get the necessary coaching to navigate the people aspects of the new role”, which he thinks they aren't usually trained well for. And, close to the third year into the role, Samuel feels prepared for the role but still considers the transition as a learning process and isn't afraid to seek help if needed.

4.1.2.16 Individual Narrative 16: Samantha

Samantha is an Electronics and Communication engineer by training and is currently a technical manager at the company. In her role as a technical manager, she manages three functional teams with over 11 direct reports. Prior to the managerial role, Samantha has held various positions as a technical contributor in other teams. One of her previous roles as an individual contributor

included some informal managerial responsibilities. Though she didn't necessarily have any direct reports, she was in charge of coordinating and managing some offshore teams for one of their projects. This exposure helped her better understand a managerial role and aided her with the transition into the new role. So, the transition did not "like totally brand-new role for [her]."

While the previous experiences gave her a purview of a manager's life, once in the role, Samantha experienced some unexpected changes, changes concerning social/relational, cognitive, and psychological aspects of the transition. Although she was quite prepared for some of these changes, some were rather difficult for her to cope with initially. One of the significant changes that she struggled with initially was maintaining a healthy work-life balance. Whereas, as an individual contributor, she was only responsible for her task, most of which weren't classified as a high priority. As a manager, Samantha is now accountable for what could be considered critical projects across the company. These additional responsibilities and the criticality weightage on her work mandate her to attend calls even beyond working hours and thereby disrupting her work-life balance.

So that [work-life balance] is slightly different, whereas in my previous role, I would join in our meetings only if I get paged. Earlier, I used to get paged only if it was a [specific] issue with our applications but now I get paged for every [function] call and this is across all of the company.

Similarly, she also experienced a change in the way she approached her work. There is a clear shift in her focus and the way she views work. For example, in contrast to just focusing on delivering a single task, she now has to look across the board and across projects to get things done. Describing that shift, Samantha says, "as for a person or individual contributor, they would focus on their individual projects that they are assigned to or a certain application, whereas now I have to be looking at the entire dashboard rather than focus on one particular piece of it." To cope with the myriad of deliverables, Samantha quickly learned to prioritize her work and deliverables based on the criticality. So, unlike previously, where she was explicitly told what to work on, she now has to identify and decide what should take precedence and how the work should be assigned among her team members. In the process, she realized the importance of prioritization and learned to be good at resource management – both skills she considers essential to be an effective manager.

Since I have to engage a lot of different teams, I pay more attention to everyone's bandwidth and timeframe before making any commitment. Earlier, it was only an individual team. I could say, because I know all my resources' design, development, testing and I could make the decision faster and easier. But now, there are peer

groups who directly report to me that we are dependent upon to me get the actions done, and they may have other priorities. So, I usually work with all of the peers to see what are the projects that need to be high-priority. And, if they are working on four or more like, you know, projects each week, I make sure what's the priority, and how they should get it done.

Moreover, Samantha moved into a different team for the managerial role, which further added to the transition's complexity. Since she wasn't familiar with the people to begin with, being a manager and motivating them was very difficult for her. She was struggling with the "people side of things". While Samantha believes this challenge may not have been that pronounced had she stayed in her same team, she still acknowledges the need for managers to build on their communication skills, irrespective of the context.

Despite her prior exposure to the world of management, moving into the new role brought about some difficult changes that she had to cope with. So, the first few months of the transition process was a steep learning curve for her. When she came into this team, she "didn't have a clue of what and how things are done." It was also quite different from when she just an individual contributor. However, she was able to navigate some of these challenges by seeking out help. Not surprisingly, she also credits her ability to "put herself out there, asking questions to learn more are important" and critical to her success in transcending the managerial boundaries. Two years into the role, she now feels much better and more settled than when she just transitioned.

For those engineers seeking to transition into the managerial role, Samantha suggests a) seeking out informal leadership opportunities; b) looking across functions and not just the assigned tasks to identify processes that can be streamlined or "any out of box ideas, so we can improve, constantly improve to make anything better, faster, all that." Doing so, she believes, would give them the required exposure to senior management and enhance their managerial abilities.

4.1.3 Cross Interview Transcript Thematic Analysis

The individual narratives give a glimpse of the unique stories and journeys of transition for each of the 16 participants. These narratives also form the foundation for understanding the primary research question RQ1: How do engineers experience work-role transition as they advance into engineering managerial roles? In this section, I present the findings from phase 2 of the data analysis process for RQ1 which includes a thematic analysis identifying the commonalities and themes in transition experiences across the 16 participants. However, aspects of transition that

correspond to the secondary research questions (RQ2, RQ3 and RQ4), aspects including the changes, skills, and challenges associated with the transition are not included in the section though. Particularly, I will detail a framework and general schema of participants' transition experience followed by cross-interview thematic analysis of experiences reflecting the various aspects of transition framework. These include a) personal situation (mainly career progression); b) motivation for transition; c) preparation and learning; d) organizational factors and support; e) descriptions of socialization or onboarding into the managerial role. These interactions among these themes is further detailed in Figure 4.1.

4.1.4 Participant Transition Schema and Framework

Cross comparison of the individual narratives has led me to develop a framework that captures the participants' experiences of transition and details how various aspects of the transition interact with one another. This pattern and framework for transition experience is further detailed in Figure 4.1. Mainly, the findings suggest that the individual's journey into the managerial transition is often dictated by their individual situation. This includes their demographics, career progression, prior experiences, etc. The transition process often starts with a motivation or a trigger often caused by these individual situational factors. Moreover, organizational factors can also influence or trigger an individual to make a transition, factors including organizational policies, training offerings, culture etc. This motivation further leads to engineers making the transition and experiencing the new role. And, while experiencing the transition and the new role, participants often cope with several individual changes, both positive and negative, develop new skills and navigate several challenges stemming from the need to cope with expected and unexpected changes. Once past this stage, engineers start to feel more settled or on-boarded into the new role. And, throughout the transition process, individuals consistently encounter preparatory or learning experiences that help them with the transition process. It is also interesting to note that individuals' experiences with external organizational factors and support throughout the process may impact how individuals experience the transition. Overall, the transition process may be very challenging or difficult for technical professionals in the initial phases but over time they may feel more prepared to handle the new responsibilities of the managerial role. While the framework provides a better understanding of the transition process, it only reflects the patterns of shared experiences

of the individual participants in the study. It may not be entirely generalizable for the engineer to manager transition phenomena.

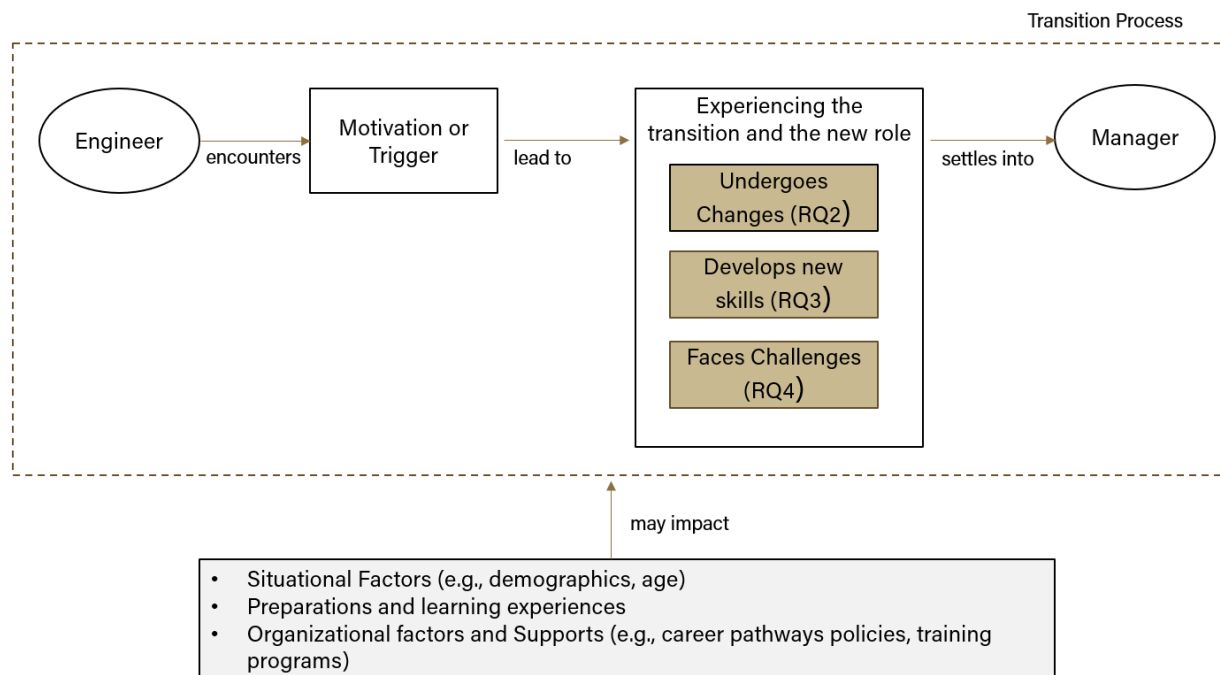


Figure 4.1. Individual participants' transition schema and framework

As noted earlier and in line with the framework, the aspects of personal situation, motivation, preparation and learning, on-boarding, and organizational support are discussed in this section. Mainly, the major themes and commonalities as experienced by the engineers and as related to the above headings are discussed in detail. In the later sections, the aspects relevant to the secondary research questions are addressed in detail. These include changes, new job skills, and challenges associated with the transition.

4.1.4.1 Personal Situation: Career Progression

Cross interview analysis of the participants indicates that most individuals transition into the engineering managerial role late in their careers. Despite moving quickly in the technical career ladder, most individuals wait for quite a number of years before making the lateral move into the managerial pathway. Though a vast majority of the participants indicated having an informal managerial experience mainly as a technical lead, often a few years prior to the transition, they

still did not officially transition into the managerial role until many years later. On average, the study participants reported having spent around 18 years as a technical contributor role before finally moving into the managerial role. The general range for the study participants varied between 10 years and 25 years of working as individual contributors before transitioning into the managerial roles. While there were a few participants (around 4) who had less than 15 years of experience before transitioning into the managerial role, there were 6 participants that served as technical contributors for over 20 years before making the transition.

4.1.4.2 Motivation for Transition

Motivation or a trigger point for transition can be viewed as the first step in the transition process. The trigger factors and motivation for engineers to consider the managerial role and pathway have some variation. These variations can be classified into three major categories. These include 1) Lack of growth opportunities in the technical career pathway; 2) Interest in the managerial pathway; 3) Desire to be a valuable resource to the company.

1) Lack of growth opportunities in the technical ladder

For nearly half of the study participants, moving into the managerial role is driven by the lack of opportunities to grow further in the technical career pathway. For these engineers, moving laterally into the managerial positions is the only way to develop their careers further. They often found themselves “hitting the ceiling” in terms of what more they can do as technical contributors or how they can grow further and challenge themselves. And, not surprisingly, most of these engineers also explained that they would have continued in their technical careers had there been more room for growth. The following quotes further exemplify such motivation for the transition:

After working several years in that technical field, I kind of felt like from a growth standpoint also, I kind of hit a ceiling, I would say from my technical side. So especially at the company, once you have reached the [highest technical contributor role] And that's what you would be, you know, there's no career path to grow after that. And so that's definitely one of the criteria for me to see how else can I grow. And so if I make a lateral move to management, you know, maybe there's growth there and I think that definitely weighed in on my decision. (Usher)

I have nothing to prove as a technical or individual contributor to the community or myself anymore. And so then I kind of laughed and thought, well, maybe, so then the bigger question is, am I at a dead end as an individual contributor? Because all I'm going to steer down is more of the same. And, you know, then I turned around and sort of had to ask the real question, which was, am I content with that?

And, as you can probably tell over time, I decided I was not. And if I stayed in my old job, I'd hate to say it, there might be an element of boredom there. It's not as challenging. I like challenging. (Leo)

I was already at the highest level as an individual contributor, I will have to stay there or I will have to pick a different path, a managerial path, if I want a growth. I thought about it and that's when I decided, okay, now I need to change this little bit and look into these managerial opportunities. After that, I talked to my senior leadership and I asked them for their advice. I told them that I want to be a technical guy and I want a career growth. They said, it's not really possible and that I had to move into a managerial pathway and choose technical managerial roles so I could still be closer to the technical work. (Samuel)

As we see from the examples above, many participants lacked an intrinsic motivation to advance into management. The lack of growth and challenging opportunities within the technical ladder often prompted them to make the transition. In fact, some of these participants even expressed an interest to continue down the technical ladder had they been offered better opportunities.

2) Interest in a managerial pathway

The second category includes nearly one third of the participants who have developed an interest in the management side of things and worked towards the managerial role even as individual contributors. Despite being in the technical pathway, for these individuals the managerial path has always been the primary choice for their next career moves. The following representative comments allude to this kind of motivation for such engineers:

- Because, as I said, this [managerial role] is where I want to be, because of my skills and technical background and ability to lead the team as a team. That's the way I see it as, a natural fit for me. (Andy)
- I always wanted to manage people and I kept an eye in for it and every opportunity I got, that settled it. (Kevin)
- Actually that was always what my goal was - to kind of get into a leadership role. That was definitely one of the motivational that I had. (Adam)

Contrary to the first category, participants in the second category were more intentional about their transition into management. Due to their interest in the management domain, they were also consistently on the lookout for relevant informal leadership opportunities and open positions even as technical contributors so as to be more prepared for the transition.

3) Desire to be a valuable resource to the company

For a couple of participants, however, the motivation for transition stems from their desire

to be considered a valuable resource to the company. They see the managerial role as an opportunity to “better my resume” and a chance to avoid being laid off. These engineers strongly felt that moving into the managerial role would give them a better chance at surviving potential layoffs during critical situations. The following examples by the two participants further illustrate such kind of motivation for the transition.

I hadn't wanted to get into this role. I took this role because I'm in my 40s now. I guess when I'm hiring engineers, I'm trying to find someone younger, right out of school. Someone that can come in and really put a lot of effort into it. I'm in my 40s, and I don't have the management experience. If we all get laid off tomorrow, I'm going to be in a difficult situation. That was my primary goal, was just to expand my resume a little bit, get some more management experience. (Justin)

[That year] the company offshored a lot of technical jobs. Which gave me a pause in direction. And at the same time, they opened up, I think it was called the [process improvement team] or something of that sort. And so I swapped over to that [managerial pathway] to change my skills, not wanting to be in the group that was targeted to be offshored or off-boarded or whatever you want to call that. (Pete)

As noted from the two examples above, the participants' motivation to move into managerial roles was driven by a fear of lay off or losing the job as opposed to a pure interest in management. For these participants, the transition was also very sudden because they were not very intentional about pursuing management careers earlier on in their careers. Their decision to move into managerial pathway seems to be impacted by an organizational situation such as ongoing layoffs or job offshoring.

4.1.4.3 Preparation and Learning Experiences

For most participants, preparation for the managerial role transition begins even before they decide to make the transition. And, for a few others, it may continue even after they are well settled into the new roles. Overall, in terms of preparation for the role, participants talked about three significant preparatory and learning experiences. These include: 1) prior experiences with informal leadership roles or their experiences as a technical lead role, 2) training programs and educational experiences, and 3) learning from mentors

1) Prior experiences with informal leadership roles

For at least more than two thirds of the participants, their prior experiences as a technical lead or an informal leader often contributed significantly to their managerial role preparation.

These preparations may, however, have been either intentional or unintentional efforts by the engineers. For instance, some engineers intentionally sought out various leadership experiences and informal managerial experiences to help prepare for their future career options. For example, as noted by one participant,

I'm always very interested in organizational growth and communication. I have always tended to volunteer for a process improvement where we're going to meet and going to drive out those things. I ran those types of things and been in leadership roles for just like I said, kind of a tiger team to go look at what are our best practices for project management. So I was running that prior to becoming a manager. I was intentionally seeking out those opportunities to prepare myself for the managerial path. (Lily)

Many other participants did not intentionally seek out any such informal leadership experiences but serendipitously benefited from their prior experiences in technical lead roles. For these engineers, their experience with the technical lead position has given them a purview into the world of management. Though the role usually did not entail managing people directly, it helped them better understand a few managerial aspects such as managing timelines, overseeing the technical aspects of the work from a high-level perspective, etc. For instance, as exemplified by Justin, the prior experience as a technical lead “helped with managing the technical side of the things during the transition.” Still, in hindsight, he wishes to “have had some more experience with just managing people” as that might have helped him with the transition.

2) Training Programs and Education

Most participants in the study have pursued some form of management training and/or education as a preparation for the transition. These include partaking in one or more of the following experiences: a) company-sponsored leadership program, b) formal MBA program, or c) PMP certification. To begin, nearly all of the study participants have reported having participated in a company-sponsored leadership workshop/training for future managers known as [OLDP], prior to the transition. Mainly, participation in the program gave them exposure to the basics of management principles. However, more specifically, most of the participants benefited from having formed connections to the senior leadership as part of the program, which eventually helped them during their own transition process. In response to how the program helped them, most participants cited finding a good mentor through the program as being their most significant outcome from participation in the program. In addition, a small majority of the participants pursued some sort of formal management education and training as preparation for the managerial role.

Namely, three participants including Samuel, Pete, and Lily pursued formal business education. All three of them received a Master's degree in either Business Administration and/or Business Management. And, three of the participants including Travis, Matt, and Pete received a Project Management Program certification. While the MBA degree seemed to have helped the participating engineers to a certain extent with the transition, those who pursued PMP certification reported to have not benefited from the certification. For example, Samuel reported that the MBA helped prepare him for the soft-skills and people side of things, and Pete credited the MBA for being better able to navigate the financial and budgetary aspects of the managerial role. However, two of the engineers that did pursue PMP certifications reported to have not benefited from it. As Pete explained, "it [PMP certification] is only for the paper, I don't think it helped directly with the preparation for the transition." In addition to the formal education, a few participants also reported benefited from just reading about leadership and management via "courses and books on leadership and management." It is further interesting to note that a few participants in their second and third year of transition expressed a desire to seek further management training or education opportunities to become more efficient leaders and managers.

3) Learning from mentors

Learning from mentors, both prior to and throughout the transition process, has been a necessary preparatory experience for all participants. Whether the participants specifically sought out mentors or were assigned by the company, or forged a mentoring relationship with their immediate supervisor, the role of mentors has been described as invaluable by all the engineers as they worked their way through the transition process. Participants often described reaching out to their mentors for any questions they may have had, both before and during the transition process. Since most engineers were traversing into a new domain that they were not necessarily acquainted with, their mentors, most of whom had a similar journey, played a significant role in preparing for the challenges and difficulties associated with the new role. Specifically, in some cases, engineers found it helpful to seek advice from these mentors on managerial and people aspects of the role. The following examples by two participants provide insights into some of the strategies used by the participants to leverage their mentors and navigate the new role:

During the transition, like during the initial weeks I had someone guide me. My previous manager and mentor helped me with my current process and I also sought out some advice from my one of my other mentors to understand what it would be like or how things would be different. So, I just had discussions, I probably would

say an hour or two a week, but I had some conversations to understand what to expect and stuff like that. (Seth)

I did actually seek out some mentors, just asking them tips, like really practical tips, and tools, and tricks that they use for managing their people, managing their time, managing their projects, to get some advice. (Travis)

Irrespective of the extent and level of engagement of the mentoring relation, most engineers found great strength in just having some mentors. They credited the mentors for being a valuable guiding resource for the transition.

4.1.4.4 Organizational Factors and Support

Organizational support – or the lack thereof, in some cases – manifested through various factors such as company policies, structures, programs, culture, etc., in turn greatly influence the participants' journey into the managerial transition. Mainly, for engineers in the study, three critical organizational factors played a crucial role in their transition process: 1) career pathway structure, 2) training programs, and 3) support from management.

1) Career Pathways

As noted in the earlier sections, an organization's policies and the structure of career pathways for engineers play significant roles in the transition process. Although, the participating company had a dual ladder career option for all its engineers and technical professionals, the option to grow within the technical ladder was only available for up to a specific job level for these engineers (refer to section 1.4). This lack of opportunity to grow further beyond a certain level in the technical stream prompted many engineers to go into the managerial pathway. This influence of organizational policies and structure on the career transition and choices is summarized by Adam, as he states:

The level four as you know that, was the highest basically level you could reach, from the technical aspect. It's kind of equaling to the management rules. But the good thing is here I can really then develop myself into a different role.

In addition, there seems to be a common internal culture of prioritizing the management track over the technical track. This is evident as many participants expressed moving into the managerial role as advancement in their careers, even though, on paper, it's a lateral move between the two pathways. Some even describe the transition into a managerial role as being a better career opportunity with bigger responsibilities. This is also supported by the views of HR leaders in the

company that I had conversations with, one of whom stated, “They [managers and level 4 engineers] have the same job pay ranges, but in reality, managers are paid more and have more credibility and responsibility, in general.” (Dolly, personal communication, September 2020). Furthermore, a vast majority of the participants also expressed a desire to “continue with the technical pathway if there were better opportunities to grow within.” This shows that the company’s structure and policies around the career pathway options significantly impacted how and when engineers transitioned into the managerial roles.

2) Training Programs

An organization’s support in offering training programs or even encouraging formal management education helps engineers prepare better for the managerial transition. As noted in the earlier sections, the study participants benefited significantly from participating in a company-sponsored leadership program. This program gave them exposure to the world of management and connected them with mentors who further guided them through the transition process. In some other cases, engineers also reported having benefited from pursuing an MBA education sponsored by the company. Mainly, engineers believed the MBA helped them prepare for the “people skills” required for the managerial role. While the existing organizational support prior to the transition certainly helped engineers with the transition, many engineers also experienced difficulty in transition due to a lack of on-going support once they made the transition. Often, engineers felt a little unprepared for the managerial aspects of their new role and wished there was more support from the organization after they moved into the new role. For example, Leo wanted more support and help with lining him up with new courses required for a manager after he moved into the new role, which wasn’t offered by the company. He further exclaimed that he wished “they [organization] continued to follow through. They were very supportive initially, but they didn’t necessarily follow through once I was in the new role.” Similarly, other participants have also expressed the need for the HR teams to provide ongoing support both in terms of training and mentorship for a better transition experience; Specifically, training related to the social and financial aspects of the role, aspects such as managing people, managing timelines and projects, delegating work, finance and budgeting, etc.

3) Support from the managers

For the vast majority of the participants, their immediate managers’ and in some cases other senior leaders’ supporting roles have been pivotal and critical for their transition experience. From

identifying their managerial capabilities to grooming them as managers, to mentoring them on various occasions and guiding them to navigate the transition, the participants' have detailed various ways their managers helped support their transition journeys. Not surprisingly, many engineers were thankful for the support they received from their managers and often credited that to the ease in their transition experiences. The following quotes and statements exemplify how participants felt about the support they received from their managers' during the transition process:

My manager at the time saw something in me and so started grooming me, and was putting me in positions to mentor new team members that came onto our team. Helping me look into how do we do our job? How do you handle when these types of situations come across you? So put me in that mentoring training opportunity. (Rene)

Honestly, I can tell you my previous manager, he mentored me very well throughout the transition process. I kind of knew almost all the processes and the admin side of the house pretty well because of him. Even engagement with the supply chain, the finance teams and all that. That experience, I think that was one area he wanted me to focus. That has helped a lot. (Adam)

I also have a great mentor in my boss, who was also my manager previously. So, he's always guiding me and helping me out, whenever I need some guidance. So that way, I'm fortunate that he's close by and available whenever I need any guidance. (Andy)

Even as a technical supervisor, I was like a pseudo manager. I was taking care of a portion of the projects, because my manager at that point gave me enough flexibility to take few things in my own hands and allowed me the flexibility to run a portion of that team I was responsible for. So I'm really, really thankful for that help that she provided at that time. That kind of helped me, you know, get into this role or transition into this role much easier. It made it a lot easier for me because I was almost there. (Steve)

Overall, the organizational support, or the lack thereof, plays a critical role in the transition process. While there could be several other organizational factors that could impact an individual's journey into the managerial world, not all aspects are discussed here. Only those factors and supports that the participants have had experiences with and those that significantly impacted their journeys are outlined here.

4.1.4.5 Perceptions of on-boarding

Cross comparison analysis of the interview transcripts suggests that participants have

variations in how they perceive onboarding into the new role. These variations can be viewed in two ways- First, in terms of the number of years, they spent in the transition before embracing the new role, and second, in terms of how they perceive their current transition status.

Table 4.2 gives a summary of the participants' perceptions of onboarding into the new role. The table includes the number of years that they spent in the new role and their perceptions of how far they are along in the transition process.

Table 4.2. Summary of participants' transition status.

Participant (Pseudonym)	Number of years into transition	Participants' current transition status (Direct quotes and interpretations of how they describe their transition status)
Matt	1.5	Acknowledges a need to still develop in a lot of "management areas."
Rene	0.8	Considers herself as still experiencing a "major learning curve."
Scott	1.5	Describes a need to work a lot to "improve myself in the current role"
Samantha	2.5	Considers a need to "get even more knowledge in the current role"
Pete	2.7	Considers himself as being "fully onboarded" "I think of myself as a true manager now"
Kevin	2.8	"I'll say one can never be fully onboarded in this transition"
Usher	2.5	Considers himself "fully onboarded" and is gearing up for the next role transition
Steve	1.5	Says he is "not 100% there yet" "Still need to enhance my management skills"
Samuel	2.3	"Still in the learning process and is not afraid to seek help"
Travis	1.2	"Still learning to adjust" to the new role

Table 4.2 Continued

Andy	1.5	“Settling in to the new role”
Leo	.8	Thinks there is still “a lot to learn”
Justin	1.4	Acknowledges the need for further training to fully transition into the new role
Lily	.8	Acknowledges the need for “self-development in a lot of areas” to become a “better manager”
Seth	1.5	Considers himself as “fully transitioned”
Adam	1.5	Views himself as “slowly starting to grow” in the new role

As evident from table 4.2, participants typically do not feel like they are completely onboarded into the new role unless they spend a considerable amount of time in those roles. Specifically, participants who spent less than a year to year-and-a-half in the new role often consider themselves as being in the learning and adjustment phase. Still others who have spent over a year or year-and-a-half start to feel like they are “settling” in the current role while also acknowledging the need to develop further to become more effective managers. Not surprisingly, only three of the 16 participants described themselves as being “fully onboarded” or “fully transitioned” into the new role. Of these, two have spent more than 2.5 years in the new role. Overall, it is evident from the findings that the participants' transition experiences are heavily impacted by situational factors such as their age, demographics, career progression, etc., as well as the organizational factors. These influences are seen throughout the transition process, from the motivation phase to the experience and adjustment phase and finally to the settling phase. Whereas the primary research question provided an overview of the transition experiences of each individual along with the commonalities in experiences more holistically, the secondary research questions will address specific aspects of the experience and adjustment phase, aspects including changes, new skills, and challenges.

4.2 Research Question 2

As engineers' transition from individual contributor roles to managerial roles, they

experience several individual changes, including changes that are perceived as both positive and negative. In this section, I present all the individual changes that the participants reported experiencing as part of the transition. Thematic analysis of the transcripts suggests that the changes can be broadly categorized into three major themes. These include 1) social and relational changes, 2) psychological changes, and 3) cognitive changes. Table 4.3 summarizes all of the themes and sub-themes relevant to the changes experienced by the participants.

Table 4.3. Summary of themes and sub-themes relevant to RQ2.

Research Question 2: Changes
4.3.1. Social and Relational 4.3.1.1. Interactions and relational changes with peers 4.3.1.2. Lifestyle changes outside of work 4.3.1.3. Increased exposure, visibility, and recognition in social groups
4.3.2. Psychological 4.3.2.1. Work-role identity changes 4.3.2.2. Changes in self-confidence 4.3.2.3. Increased emotional burden
4.3.3. Cognitive 4.3.3.1. Change in mindset from doing to delegating 4.3.3.2. Focus Shift from individual tasks to big picture thinking 4.3.3.3. Changes in role expectations 4.3.3.4. Changes in job skills

4.2.1 Social and Relational Changes

4.2.1.1 Interactions and relational changes with peers

The most significant social and relational change for participants in the engineer to manager transition included how they interacted with their peers and colleagues both at work and outside of work. Particularly, at work, most managers found interacting with their reportees who were once “their peers at the same level” to be quite challenging. Pete aptly summarizes this difficulty when he states:

I was an individual contributor on this team. I had worked with this team for over 12 years. I then took a manager role with them. So, the relationships that I have built in those 12 years was more of a friend than a colleague type. When you switch onto manager role, it becomes difficult to maintain the friendship role versus the manager role because at some point, you got to tell them to work too or what they've done is wrong, and you got to do the performance evaluations and all that sort of stuff. So to me, that was the tricky part of how I would go about doing it.

The managers often felt that the interactions and relationships with their direct reports became “more formal” and “distant” during the transition. These contrasted with the more friendly and open conversations that they had earlier before the managerial transition. There was also a conscious effort on the part of the managers’ to “maintain a certain distance” in their conversations and to “not indulge” in office talk, especially on topics such as “performance appraisals, promotions, etc.” While most participants were concerned with these changes in interactions with reportees during work-related tasks and activities, a couple of the participants observed changes during social events as well. One participant mentioned that he wasn’t invited to as “many social hours after work anymore.” Another talked about “more quieter” conversations during social gatherings outside of work. Although these relational and social changes and adjustments were very unpleasant and challenging for the participants, interestingly, most of them were also aware of how the changes were necessary for the new role.

4.2.1.2 Lifestyle changes outside of work

The change in the title also meant a change in work-life balance for many managers. The new role was often associated with additional responsibilities and demands, requiring extra effort and time spent on work on the part of the new managers. While this meant “extra working hours,” or “attending weekend calls and texts,” or “not able to work from home anymore” for many, managing work-life balance was particularly important for Leo and Rene. For example, in describing the impact of being a manager on his lifestyle, Leo quips, “I would argue that being a [manager] is a lifestyle and not a choice, I think that's the running joke.” In another example, describing the difficulty of finding the right work-life balance after becoming a manager, Rene states:

Work life balance – that is huge to my husband and I. Our relationship, our family we have, we have little ones who run around, that's super important to us. So work

life balance is super important to me. The first couple of months, it was difficult, you know, just absorbing all of it new.

While many managers believed there was some shift in their work-life balance with the scales tilting more towards the work side, they also accepted that the change was a natural part of the transition and was either prepared for it or made conscious adjustments to cope with these changes. In particular, the following quotes show how Leo and Rene coped with the lifestyle changes mandated by the managerial role:

I'm making the conscious changes. And putting expectations on myself for my work-life balance has been super important. I, you know, I still take my daughter to school every day because that's still important to me. I still have also chosen to only work late at night after my daughter is in bed. And my husband and I have had our own, we call it face to face time, and then if necessary, I will work late that night to get caught up or whatever. So, it has been a change because I didn't have to do like late evenings or early mornings and things like that in my previous individual contributor role, so just finding that balance was different. (Rene)

And for some of them, when I say this, I have to apologize and say, "Hey look, just so you know, I have kind of a hard policy, which is I will check my phone on the email side once a day on Saturday and Sunday. I'm not; if you really need me, you really, really need me." You've got to go with that text message, or you got to go down with that phone call boundary. You got to break the boundary, right? You can't, you can't be dissatisfied by email because it's hard for me to understand when you send an email, and it doesn't have urgent, or it does, you know, is it business hours urgent or is it, you know, is there a real emergency? (Leo)

These experiences and examples demonstrate that even for those managers such as Leo and Rene, who found the lifestyle change difficult in the beginning, they eventually accepted and learned to adjust to the changes. They also found ways to make the change less stressful by prioritizing what was important to them.

4.2.1.3 Increased exposure, visibility, and recognition in social groups

In contrast to the challenges stemming from the changes in interactions with their peers and life-style changes, nearly half of the participants also experienced positive social relational changes during the transition as they noted increased exposure and interactions with several social groups at work. Many of these managers indicated that in contrast to their role as an individual contributor, their new role entailed a lot more formal interactions and exposure to people spanning different functions and teams within the firm, especially the senior management. For example,

Justin, who appreciated this change, describes how he likes “the broadening exposure, getting to know more people within the company and making more connections with people both within the team and with other engineering teams.” He further notes that moving into a managerial role also helped him with connecting and networking with the senior management, when he states:

A lot of the VPs and the Directors, I really had no reason to interact with before. There'd be a meeting every now and then, but that's about it. Where now, it's a daily thing. There's, I guess, more relaxed conversation with some of the upper management. They joke around as much as everyone else. It's a lot easier dealing with, like I said, the VPs and the Directors now. I think just the exposure, the constant exposure in meetings.

In addition to the increased interactions and exposure to wider social groups, many managers also recognized that their social interactions were a lot easier in their new role. Managers attributed this ease in social interactions to their managerial status, as they believed that people gave more value and weightage based on their titles. Moreover, a couple of these managers also noted a stark increase in their visibility and recognition in social groups both at and outside of work. These changes are highlighted in the following statements:

- The change, the way I would describe it is that, when you have a formal position or title, it makes you more visible in the organization. There's more visibility and more appreciation and more acknowledgment. (Andy)
- I'm like wow, you can be like a Nobel laureate, and no one would notice. But, if you're some sort of low-level director/manager, people [recognize you instantly]... that's kind of bizarre”. (leo)
- So, one thing that I would say there is when you are negotiation, the amount of influence you can bring into the arguments, it certainly changes with your designation, and it'll help make the decisions influence a little bit better when you become a manager than when you are an individual contributor.(Kevin)

Similar to Kevin, Usher also demonstrates awareness of the influence that he may have on people due to his title. Accordingly, he made conscious efforts not to influence or sway their team members in any one particular direction. The following example shows one such incident where he refrained himself from voicing out his opinions to avoid influencing his reportees' choices.

I feel like I really want to be part of those discussions, but at the same time, I try to weigh what I say. Because at the end of the day, you only get to a good technical solution if you build consensus and, you hear everybody's opinion on things and,

being a director and sitting in those calls, you know, what you say, even if you don't feel like it should weigh more, it obviously weighs more in people's minds. (Usher)

These examples suggest that while, on the one hand, increased responsibility and influence is appreciated by the participants, on the other hand, the same influence may come in the way of dealing with their team members. Specifically, team members or direct reportees may not be willing to speak up against the managers. This may stem from their perceptions of managers as being more powerful than them and/or due to the hierarchical structure and culture of a company that prioritizes the managerial title. Hence, the managers need to ensure that their newfound influence isn't coming in the way of more meaningful conversations with their direct reports or other team members.

4.2.2 Psychological Changes

4.2.2.1 Work-role identity changes

Nearly all participants' in the study have experienced some form of change in the way they self-identified themselves in their work roles. As individual contributors, most of the participants' self-identified as being an engineer or technical professional. In their new roles as managers, they self-identified themselves as being technical managers. While the identity change from being an engineer to a technical manager is common for these managers, there are variations in how they perceived their new identity of that of a technical manager and in how they navigated between their technical and managerial selves as a part of the new role. These variations can be categorized into three types. The first includes managers who still viewed themselves as being engineers/technical professionals at the core, but with a secondary managerial identity. The following quotes describe how a couple of managers still held on to their technical identities. Infact, they also considered technical aspects more critical to their job roles while trying to accommodate to a certain extent the additional managerial side of their new work role:

Yeah, I still think of myself as a technical person, but I have the added responsibility of people management. And that, I don't think that is hindering my technical skills by any means but is also adding and giving me an additional asset. (Seth)

That's interesting. I just said it a few minutes ago; I always catch myself saying to coworkers and my team. If someone asks, I still say I'm in engineering; I'm with [function] engineering at the company. It's been a few years now, but I don't so

much identify with the manager role yet. I guess more so than someone getting hired specifically for that, with no previous background in engineering. (Justin)

In contrast to the first type, the second type consisted of managers who considered their managerial selves to be more significant than their technical identities. These managers believed shifting their priorities from the technical side to the managerial side was more critical to their role as technical managers. The following quote describes how one such participant emphasizes the managerial part of his role as compared to the engineering role.

I would say managerial as the priority. As one of my peers says, I don't know what's the term, the laparoscopy of technical stuff has taken place, or the lobotomy of my technical stuff has taken place. Technology has moved ahead, right? Like with any language, you've gotta be in it to do it. And so I promote high-level perspective. I can grasp everything, but if someone were to tell me to go in and write code or something of that sort, maybe I can do the simple stuff, but the highly detail stuff I probably wouldn't be able to do. I could probably walk through code and talk to it and stuff like that, but I wouldn't be able to go in and write. So I'd say I am more managerial now than technical. (Pete)

Similar to Pete, Andy also talks about his efforts in fully adapting to the managerial side of the role, evident, as he states, "I'm identifying other people who can take over that responsibility, the technical side of things and, I become more of a true manager, where I can groom people for future." Both Andy and Pete explicitly state their desire to become and embrace the managerial role in its entirety. Both of them emphasize how they want to become "true managers" and let go of their technical side.

The third and the most prevalent type consisted of managers who often switched their technical and managerial identities based on the situation and context. These managers did not strongly identify as primarily technical or managerial. The following quotes describe some of the ways that these managers navigated between their technical and managerial role-identities based on the need, context, and/or the situation:

It's definitely the combination. So, the way I tell my team is, I'm the manager only if they really need a manager. Otherwise, I'm like one of them, as a technical person. But of course as a manager, we also have to care for my team. And for those, I know that I will be there for them for sure for them. But in day to day life, pretty much you really don't need a manager looking over you, I mean that's my feeling anyway, at least for my line of work, my team's line of work, that is what we are. (Samuel)

In the role that I'm in now, it's very much both because, there are times where I needed to go deep on one particular thing, and you know, like for example, a

certification, a technical certification report on how, you know, the particular accessory is drawing power in interacting with the [device]. And so, you got to have some pretty deep understanding of how that interaction works. But at the same time, I'm able to, you know, go and present to the senior vice president on financial goals or business with revenue and margin and cost and, you know, so I would identify myself as being flexible to be able to adapt to various scenarios. (Travis)

It is a combination based on the, you know, the folks I'm with. So, for example, when I meet with my management team, or I have my staff meeting, I wear the hat, I wear the management hat, and I try to communicate what, you know, I hear from my leaders on, you know, what I should, you know, what they should be doing, or what, what's communicated from a company standpoint, right? But if I'm in a technical discussion, I very much consider myself a technical leader. (Usher)

As seen from the above examples, participants in the third category including Samuel, Travis, and Usher often navigated between the dual identities of their technical and managerial selves.

Overall, irrespective of the differences in how engineers experienced changes in work-role identities, they had to make a few adjustments to cope with the identity changes. Mainly, for the first category of participants, these adjustments implied not being able to devote as much time and effort towards the technical aspects of their work much against their liking. Yet, in some instances, they found a way to stay closer to the technical side. For example, as Kevin notes, “From my standpoint specifically, personally, I get into the weeds. I look at how a certain individual arrives at a solution. So I do it myself. So I don't stay far away from my technical truths.” On the contrary, for the second category of participants, the adjustment included “making conscious efforts to delegate the technical work” to grow into the managerial role. And, for the third category of participants, the adjustments meant knowing when and how to prioritize the two aspects of the role – managerial and technical.

4.2.2.2 Changes in self-confidence

In addition to the changes in how they perceived their self-identity, three managers have also reported changes in their self-confidence. Partly owing to having to deal with uncertainties and unexpected challenges stemming from the transition, these engineers did not feel very confident about themselves or their capabilities. However, as they progressed in the role, they started to experience positive changes in self-confidence that further helped them with the process. The following quotes exemplify some of the participants' experiences with this change:

I would say that I feel more confident. At first, I struggled with not knowing what to do. And, I would say I'm much more confident in that. And I also feel much more confident in my load capacity - of what I believe I can handle, and prioritizing based on it's impact to [company]. (Travis)

My current leader is challenging me that, that one can be confident while still being humble, and so as I'm working that change...Working towards remaining humble, because again but also being confident that I can do this, um, and lead my team and then I am the right person and that the leader I have, who hired me knew what they were doing. So that's kind of been a psychological shift for me to, to own that I can do this. (Rene)

To me, especially when I was not a manager, any time we had the staff meeting and my manager, even presents herself or himself as confident in what our teams is doing, it kind of used to help me. And, I think that really helps. And so I try to keep that going and working towards that building the confidence or even projecting it. (Usher)

Based on the examples highlighted above, it is evident that while some participants clearly feel more confident compared to when they started, some others are working towards improving their confidence to be more effective managers. It is also interesting to note that, Rene's changes in particular speak to the dilemma often faced by women and other minorities of needing to balance humbleness and confidence. This wasn't the case with both Travis or Usher, for whom this change was rather straight forward. Although they struggled with the lack of self-confidence in their early days of transition, they eventually found a way of developing it. In contrast, however, Rene, at the time of this interview, was still struggling to be more confident in her ways as a leader. Rene's experiences are further discussed in Chapter 5 within the broader context of highlighting experiences of female participants such as Rene.

4.2.2.3 Increased emotional burden

Nearly one third of the participants reported experiencing emotional changes related to the transition to a managerial role. Mainly, the managers expressed concern that they were dealing with increased emotional burdens in their new roles. This is because they were now responsible for not only their own well being, but also the well-being and emotional state of their team members. For example, one manager noted,

As a technical individual contributor, I have accountability over myself, maybe a little bit of an application. But as a manager, I mean, as I said, I am supposed to be the role model for the rest of my team, so 100 - 120 people looking on you for

guidance, at any moment, any point. You can't just have your emotions take control over that whatever is the scenario. I mean you just can't get animated over a call or when you talk to them. (Seth)

And as another manager commented,

So my journey from an individual contributor into this, evolved thinking about other aspects which are not technical too, now I have to keep people happy. I have to make sure the team is being cushioned. I mean cushioned in the sense, they are working hard, but I need to make sure that their needs are also getting met. To know that okay they're happy. (Steve)

For some of these managers, the seniority of the role also meant they had to deal with “high pressure situations” all the while ensuring they remain “calm and reliable for their reportees.” The following examples further demonstrate how a couple of managers dealt with such situations:

So as a manager, you got to have patience. There will be times when your nerves will be tested and you need to handle yourself under pressure. You shouldn't be crumbling when your team relies on you. And if you're strong, the team will be able to keep their cool and you know, deliver. (Steve)

I used to joke that I was never the calm one, but I would also say as a manager when you see things melting down, you want to stay calmer for the team. As a manager, I am put in very stressful situations and also have to deal with crisis situations like recently I was in charge of crisis management during Katrina hurricane. It's very stressful. (Leo)

As evident in the above examples, perhaps not surprisingly, these managers also advocated for cultivating skills and habits including, “maintaining calm”, “staying positive”, “being patient”, and “toughening up” as coping mechanisms for dealing with the increased emotional burden associated with the new transitionary role. However, as stated by one manager, coping with the stress was often not easy in the first year of transition, but that he “started to feel more comfortable over the time.” Overall, we note that these managers who dealt with increased emotional burden eventually learned to cope with the changes. Often, they had to develop emotional intelligence skills such as empathy, perspective taking, leading teams with positivity, and the like to cope with some of these changes. They also learned to prioritize their own well-being to deal with stressful situations.

4.2.3 Cognitive Changes

Cognitive changes included changes related to the mind such as thinking, memory, perception, and learning. Specifically, a majority of the participants experienced one or more of the following types of cognitive changes during the transition, including: 1) change in mindset from doing to delegating, 2) focus shift from individual tasks to big picture thinking, 3) changes in role expectations, and 4) changes in job skills.

4.2.3.1 Change in mindset from doing to delegating

A vast majority of the newly transitioned managers experienced challenges in delegating technical work to their engineers. As engineers and individual contributors, the primary responsibilities of the participants was generally confined to doing and delivering technical intensive individual tasks. But as managers, they were now required to deliver and manage multiple projects and teams. This meant that, in contrast to going into the nitty-gritty details of the technical work they were now required to delegate the work and get things done in a timely and efficient manner. This change was often difficult for the new managers to accept as they still continued to focus on doing all the technical tasks by themselves. The following quotes by participants describe this challenge of the transition:

It's hard to delegate, I think. I see that in some of the other managers too. The phrase everyone uses, it's easier just to do it yourself than to teach someone how to do it over and over again. That's probably the biggest challenge, is just to let go some of the responsibilities. Which I still need to do. There are still things I'm doing that I shouldn't be doing. (Justin)

You know, sometimes it's difficult for me to... I'd say, you know, one of the challenges, at least me personally is to just let it go and let my people do it the way that they want as supposed to, you know, how I might do it. (Travis)

As noted in the above examples, a few of the managers found it difficult to delegate. This often stemmed from their belief that they do the technical tasks themselves more efficiently than if they delegated it to others. Furthermore, for some of these managers, the familiarity of the technical work also meant they had a strong preference and inclination for how they wanted the work to be done. This made it harder for them to delegate the work to their engineers, especially if it didn't align with their expectations or way of thinking. However, a majority of the managers not only acknowledged their challenge in dealing with the shift from doing to delegating, they also

made conscious corrective efforts for learning to delegate. The following quotes highlight how two managers, Usher and emphasized the need for them to make the change from doing to delegating:

So that's one thing that definitely something anybody transitioning needs to be aware of. If you're a manager, you know, there are things that you can do on your own. You still delegate items to others and have different tasks for different team members. But a lot of it is still, you feel like you can get in there and get in the weeds and get your hands dirty and get the work done, right? So as, when you move to a role which has a wider scope and responsibilities in general, then, you know, one or two projects you're working on, that means you need to also learn to delegate and more than delegate you need to also be able to trust your team more. (Usher)

[As a manager] I can't give one more time than the other. It has to be whatever is more immediate deliverables that I need to focus on and then shift my attention. And that's where all that trust and delegation comes into play. I need to just trust that this person's got this and I can come back to them later and get my answers. But I can't be spending any, the same time on doing the [technical tasks]. (Usher)

The other thing was, earlier I was more hands on and having a technical background, I was always in the middle of things. But, with a larger portfolio now, that became more challenging, to spend and specifically devote that level of attention to every single thing. To every single technical detail. I'm identifying other people who can take over that responsibility, the technical side of things and, I become more of a true manager, where I can groom people for future. (Andy)

The above examples emphasize how managers acknowledge the criticality of delegation as they move beyond doing the technical hands-on work in their new roles. In addition, a few of these managers also signify the importance of learning to trust their employees with the technical work as essential for delegation. They reported that being able to trust the engineers to deliver the technical work and not dictating how the work should be done helps them cope with the difficulty of delegating the technical work. Overall, these experiences reveal how recently transitioned managers are required to learn to shift their focus from doing more hands-on technical work to delegating the work to their engineers. And, most often this change was very difficult for the managers, but they consciously made an effort to overcome it.

4.2.3.2 Focus Shift from individual tasks to big picture thinking

More than half of the participants described some sort of a shift in their mindset, particularly in the way they approached their job as they moved into the managerial roles. With

increased scope and responsibilities in their new roles, the managers were required to think beyond just delivering their individually assigned tasks. Mainly, they were now mandated to think broadly about their teams' deliverables as well. The following statements exemplify how some of the managers felt about the shift in focus from individual thinking to thinking broadly about the teams:

[As a manager] In many aspects you don't think about yourself. You have to think about the entire team. Make sure the team members are fully grouped with what and how they want to complete the work. Obviously, thinking about others. Now to be honest that thinking was not there prior to this new role. I see that as a positive change... When it comes to the individual, all you have to decide for not only for yourself but for your team members, that kind of I see there, my thought process has changed big time. (Adam)

As a manager, I feel like I need to take care of not just my needs, but everyone's [team members'] needs, to make sure I'm following up on everything. (Lily)

Okay. I delivered what was asked from me [as an individual contributor]. But when I get caught into this elite role, it's a little different in the sense that I'm not just responsible for my piece of the work, I'm also responsible for everything that my team is required to deliver. (Steve)

In addition to the shift in mindset from individual focus to team focus, the new role also mandated managers to think broadly across the business and not just their technical specialty. Managers had to quickly learn to think broadly about multiple projects and deliverables rather than a single assigned technical deliverable. The following quotes aptly summarize how some of the managers felt about broadening their thought processes to accommodate for the new role responsibilities:

The changes with the new role- just the acknowledgement and awareness that now I have to absorb more strategic things rather than just, day to day, delivery items, right? I think that's more on the cognitive side. I had to be aware and in my interactions, not only look at, you know, today or tomorrow. But, three months, six months, one year down the line or even longer. (Andy)

I definitely think there's a change in the cognitive zone. To be specific, for example, when you're talking, an individual contributor looks at it from a standpoint of his deliverable, his field of view, if you will, is going to be concentrated only across his own task in the project and the delivery that he has on hand. But, after you become a manager, you're looking at a much holistic view. And if you're talking to another function, you look at what implications that your conversation would have on all the other deliverables that are on the horizon. (Kevin)

From one perspective, I feel like you kind of step up and you're trying to look across the board and just kind of at a broader level look across all your projects and your processes and expand your thoughts, it's not just your one project focus. (Lily)

So to start, when I first joined this team, I didn't have an understanding of the big picture at the company. So I was an individual contributor and I was given a piece of the puzzle and I was only looking at that particular piece and solving that piece alone. I had no clue of how that piece fits into the big scheme of things... my role evolved from just that piece of the puzzle to understand the bigger scheme of things. To understand how these things, how all these different pieces of puzzles come together to form something. (Steve)

As exemplified in the quotes above, participants used the phrases “big picture thinking”, “strategic thinking”, “thinking across the board” etc., to describe their new ways of thinking as managers. This new way of thinking clearly contrasts with their mindset as an individual contributor, often described by phrases including “technical task”, “hands-on”, or “individual deliverable.” While many managers acknowledge and show awareness of this cognitive shift as a part of the transition, surprisingly, they do not refer to the shift as being particularly challenging or difficult. Rather, one manager even commented that he viewed “it as a positive change”.

Nonetheless, owing to the broadened focus of thinking, some managers also acknowledged and talked about the various adjustments and strategies they had to employ to cope with these cognitive shifts. These included being well organized as well as being able to prioritize work based on importance. For example, the following quote by Lily emphasizes the importance of learning to be more organized in order to meet the cognitive demands of the new role: “I feel like I'm being pulled in 100 directions, so trying to ... one of the things, even though I was a project manager I feel like I was an extremely organized person. And I feel like I'm having to learn new ways to organize.” Further, Lily also goes into detail explaining how she started to take “more notes digitally” to refer back to things. This she said was particularly helpful when she was dealing with “too many things” that spanned multiple projects. Similarly, a couple of other participants talked about being able to prioritize as critical for efficiently coping with the aforementioned cognitive changes. For example, Samantha, in describing her strategies for dealing with the cognitive changes notes:

Since I have to engage a lot of different teams, I pay more attention to everyone's bandwidth and timeframe before making any commitment. Earlier, it was only an individual team. I could say, because I know all my resources' design, development, testing and I could make the decision faster and easier. But now, there are peer groups who directly report to me that we are dependent upon to me get the actions

done, and they may have other priorities. So, I usually work with all of the peers to see what are the projects that need to be high-priority. And, if they are working on four or more like, you know, projects each week, I make sure what's the priority, and how they should get it done.

Regardless of whether or not they adopted specific strategies or skills such as organizing, and prioritizing, a majority of the managers eventually learned to cope with the heightened shift in their mindset. Most of them recognized that they moved away from thinking purely technical and as an individual contributor to a more big-picture and team-oriented mindset.

4.2.3.3 Changes in role expectations

In talking about the significant cognitive changes, one fourth of the participants also referred to changes in role expectations. Particularly, they talked about how their perceived expectations of the managerial role before the transition varied widely from the reality of the role. Primarily, prior to the transition these managers believed that the managerial role was “way easier” and required “lesser effort.” However, in contrast to their perceptions, once the participants’ moved into the new role as managers, they soon realized the amount of effort it requires. The following quotes particularly highlight this change:

I thought it [new role] would be a lot less downtime, and a lot fewer issues. More just delegating. I guess it was less of the people side of it I thought, or I didn't know took up so much time. Just managing people, not so much managing networks. That's something I had no idea that was such a big part of this role. It's never been brought up. I mean looking back now, yeah, sure, it makes perfect sense. It's going to be a huge part of this job. (Justin)

So when I was an individual contributor, I always thought the manager role was much easier. Because you're not really delivering a particular deliverable. You're only ensuring that your deliverable is met. So, I always thought it would be much easier becoming a manager. But now, especially since I have these managerial shoes and going back to my initial thing, when I said I always go back into the weeds, I never stay far away from actual execution. It's much more harder. My perception was it would be easier, but, becoming a manager and doing it, and delegating, and negotiating, not negotiation per say, but delegating and then driving accountability is much, much harder than what you think, particularly when you are delivering it. (Kevin)

I always thought that manager role was a little easier. But, I think, the people side of the house in the manager role is more tougher than you think. I think when you have to, as I said, to give performance evaluations and stuff, I think it's tougher. The technical part is pretty easy. (Pete)

A consistent pattern in the change was how managers misunderstood the people side of their roles as being simpler and requiring less effort as compared to their technical work. This also led to the managers being more appreciative of their previous managers, which wasn't the case before their transition. However, not all managers experienced the mismatch in expectations and the reality of their managerial roles. A couple of managers stated with certainty that they were not "taken by any big surprises" as they moved into the new role. These managers believed that their involvement in voluntary or informal leadership and managerial activities during their roles as individual contributors and their awareness of a managerial role helped them be prepared and to see the role for what it is.

4.2.3.4 Changes in job skills

Nearly all participants echoed the need for having to develop new skills to be effective in their new roles. While many engineers considered themselves as technically competent for the new role, they often recognized a skill gap in the people and managerial aspects of the new role demands. And, as they transitioned into the managerial role, the skill-gap was more evident, putting an onus on the engineers to adapt to the new role by developing new skills. Although characterized as a difficult change to cope with, it was mostly viewed as a positive change by the participants, as acquiring new skills helped them grow as leaders and individuals both professionally and personally.

The following section (section 4.3) details the specific new skills that the participants talked about as essential for their new role. Evidently, there is an overlap between RQ2 and RQ3 in terms of skills and competencies. This is because, it was essential to highlight the changes in job skills as an important emergent theme concerning RQ2, as the participants viewed them as critical change experiences. To complement these findings further, in RQ3, I will explore the kinds of new skills that the participants viewed as essential to develop for their new role.

4.3 Research Question 3

While it is evident from section 4.3.3.4 that participants experiences changes in job skills, in this section, I detail the new skills that the newly transitioned managers perceived as essential, skills required to both navigate the challenges of transition and also to survive in their new roles.

These are classified into 5 major categories: 1) people management, 2) communication, 3) resource management, 4) strategic thinking, and 5) administrative. Table 4.4 provides a summary of the major themes corresponding to the research question 3: What new skills do engineers perceive as critical for their survival and success in their new roles?

Table 4.4. Summary of themes corresponding to Research Question 3.

4.4. Research Question 3: New skills
4.4.1. People Management
4.4.2. Communication
4.4.3. Resource Management
4.4.4. Strategic thinking
4.4.5. Administrative

4.3.1 People Management

In their new roles as managers, nearly all of the participants acknowledged the need to develop the “people skills” or “skills required to work with people.” Bucketed as people management skills, skills such as motivating a team, influencing teammates, managing conflict among team members, showing empathy, etc. were all considered essential skills to be developed by the participants. The following quotes describe some of the ways in which the participants spoke about the need to develop people skills:

I would say, once you definitely look to go through whatever is available in terms of courses for people skill, how do we manage and deal with people with diverse backgrounds. Because when you are leading or managing a team, the individuals will be from different technical and professional and other backgrounds. They all have to come together. So, that training to improve people skill I think is important for any manager. (Andy)

You interact with a lot of people as a manager. So, good working relationships and people management are critical skills for managers to develop. Like treating people with respect, and stuff like that and all those small little things would add up. (Seth)

If I had to pick something [skill to develop] from a manager perspective - I don't even know what it would fall under, but it would be managing more difficult engineers or how to get an engineer or an employee motivated or what to do if they're not motivated, things like that. (Matt)

Sometimes obviously there could be instances too where people, they have some family issues and they are hesitant to bring them up. To kind of get a feel of it, talking to them and finding a replacement for the time being that somebody else can take this work forward, whether they can take some time off or at least spend some time with the families of those aspects. So, I learned to be more empathetic. (Adam)

As seen from the examples above, many managers struggled with the people management aspects of their new role. Specifically, managers talked about the need to develop skills that could better help them not only deal with people but also lead their teams more efficiently. We can also see that once in managerial positions, participants tend to demonstrate awareness and increased sensitivity to their team members feelings and emotions. This is particularly evident, as they describe their need to be “respectful”, “empathetic”, “mindful of the diverse backgrounds of people”, etc. to be better at managing and leading people.

4.3.2 Communication

All participants in the study frequently recognized the need to develop their communication skills at some point during their transition. Specifically, in the areas of executive technical communication, as well as listening skills. For five participants, it was the upward communication with the executives that challenged them. Mainly, their new role required them to frequently communicate with the senior leadership or executive suite members, including to consistently update them of their team’s progress. This is an area that most participants reported struggling with. Though communication among peers was not new them, communicating with senior leadership entailed a different skill set that they reported a need to develop. The following quote by Travis aptly summarizes the need for managers to develop executive communication skills:

I think having crisp communication [is essential for the transition], if you're going to be communicating up to senior management, you got be able to know the right level of detail to explain to them. I mean management typically wants to know about the technical details of something. They just don't want to know everything, but just this impact of it like If you've got some options or we believe we can get it done in one week. Just high level pros and cons, just being able to have crisp communication sometimes be a challenge for technical people, I have seen. I have kind of developed that skill by trial and error. I also got feedback from my manager to be more crisp here and leave that out, just focus on this, etc. (Travis)

In addition to executive communication, participants also recognized the need to improve their listening skills. Mainly, in order to be effective as team leaders and managers, in some cases

participants' felt the need to listen to what their team members and direct reports have to say, and in other cases listen to what other stakeholders have to say before making any decision. This helped them not only gain the respect of their team members but also helped their team members feel more valued and engaged at work. The following quotes describe a couple of participants' experiences with needing to develop the listening skills:

I think my biggest skill that I picked up is listening. I think that's the big one because when you talk to a customer, generally they like to talk and go over wide and broad varieties of subjects. As a technical person who has technical skills, you also need to pick up the bits and pieces that they are talking about to make the technical design and architecture from a broad range of subjects. So listening I think is a big one. (Pete)

So in order for you to succeed as a technical manager, first thing you need to do is stop bringing your technical stuff into the table and stop and start listening to everybody's problem, I'd say, everybody's solution. So, I learned to develop my listening skills. (Kevin)

As seen from these examples, participants considered communication skills, particularly in the areas of executive communication and listening as new skills to develop. It is also interesting to note that, in order to develop these skills, the participants also recognized the need for them to let go of their technical way of doing things. In all the three examples, we see that participants make references to how they needed to tone down their technical way of thinking in order to be more effective at listening and executive presenting. For example, Kevin, goes as far as saying that managers should avoid bringing in technical stuff into the table in order to start listening to their team members.

4.3.3 Resource Management

Resource management includes skills related to managing resources including financial, human and time. Mostly, as managers, the participants are required to manage and deliver multiple projects/tasks within certain time constraints. This requires a lot of planning on how and when to get things done with the given resources. In contrast, as engineers they were primarily focused on delivering a single task or a project as a single person team. They didn't have to scurry around for resources to get things done. So, as managers, more than half of the participants reported to have struggled with identifying the "right resources for the right job" and recognized the need to develop

resource management skills to effectively get the work done. The following examples demonstrate how participants described this need for developing resource management skills:

Basically, in this new world [managerial world] where we are, I mean you get to know the requirements later. You know, the project timelines and the completion targets first, right. Then you have to ensure that the right resources and right people are working on at least the fast track projects. I needed to learn that skill. (Adam)

Like, previously, I was not fully 100% responsible to go make sure we have resources. Right now, it's more of making sure you have the resources, hiring them and, having the ability to train employees or hire employees. (Scott)

In addition, a couple of managers including Lily and Travis also talked about the need to develop skills to manage multiple project timelines and deliveries. To this end, they also specifically talked about leveraging software tools such as OneNote, Excel etc., to easily navigate between projects and timelines. Detailing the specific strategies and tools that Travis uses for project management, Travis states:

I mean, just like for managing like the assignments in workload that your team has. One guy shared with me an excel tool that he had created that was able to give you kind of both a quantitative and a visual graphical representation of the work that you're teeing up, say a person has over time, so you can kind of fill for their capacity over time.

As seen from the above examples, managers not only need people skills to lead and manage teams but also the skill set to plan, hire, and, develop right talent for the jobs. They also need to be adept at project management, which further requires them to utilize and leverage relevant software and tools.

4.3.4 Strategic Thinking

At least one fourth of the participants' recognized the need for engineers to develop strategic thinking skills to be more effective as managers. Strategic thinking mainly includes thinking more broadly about what the business needs are and integrating them into the work. Mainly, as managers, they are now required to think more broadly about their work and its implications. In contrast to just delivering their assigned task as contributors, as managers they are required to think about how their work impacts the company at large. In some cases, they are also required to think about what the company's needs are, and then align those needs with their work deliverables. As seen from section 4.2.3.2, managers often find themselves needing to shift focus

from individual thinking to big picture thinking. And, this change often mandates them to develop their strategic thinking skills. Since most engineers were not trained to cope with this new work demand, often participants found it difficult to develop these essential skills. For example, in detailing how he goes about doing strategic thinking required for his job, Andy talks about asking himself the following questions – “okay, how do I see our team our company in the future? How do we get to, you know, the top five or top three, you know, in the industry?” Similarly, in describing the need for engineers to develop strategic thinking skills and what that entails, Kevin explains:

The biggest tool [an engineer] could build in his arsenal is developing his perspective so that he looks at the big picture and strategic thinking. So, an individual contributor almost always looks at what's currently on his plate. But what he forgets to look at is how his deliverable affects the bigger picture or the bigger task that the company has. If you start eyeing your deliverable or your team's deliverables through your company's deliverables, you would definitely look at how your contribution impacts the overall deliverable of your company. As long as you are able to understand how you can, how your contribution has an effect on the global, that will be much easier for the transition.

While Kevin and Andy explicitly mention strategic thinking skills, a couple of other participants also talk about the need to develop such skills in other ways. For example, Usher, indirectly references strategic thinking skills when he talks about needing be aware of the industry updates and bringing in the right technologies to the company. In another instance, he also talks about needing to perform major transformative initiatives within which require him to think about what's good for the company. As seen from these examples, as engineers step into managerial roles, they may come across situations that need them to think strategically and broadly about their work. Mainly, they would have to think about their work implications to not only their team members but also the company at large, implications including on the financial and other benefits to the company.

4.3.5 Administrative skills

For all managers, their new role entailed doing administrative tasks required for running a team, such as doing performance reviews, deciding on pay structures, approving employee leave requests, etc. for their direct reports. Yet, some participants felt like they weren't trained to handle these tasks in their previous roles. Consequently, only three participants talked about a need to

develop in this area. For example, Pete describes this difficulty when he states, “I think when you have to, as I said, to give performance evaluations and stuff, I think it's tougher. The technical part is pretty easy”. Similarly, the following quote by Travis highlights another such experience of struggle and the need to develop administrative skills:

I mean, [needing to develop] even some of the administration aspects of being a manager and doing administrative tasks of direct reports. You know, there's nobody who shows you how to do it right? For example, how to just do some of the administrative stuff like throughout the year- you have to record how many resources you need full-time, come up with their performance reviews, etc. Just that aspect I think you just got to kind of learn it or ask other managers who've been doing it for years, that is what I did.

While most all participants described having additional responsibilities of doing administrative tasks such as performing reviews, setting up pay structures, etc. as managers, only a few of them reported to have felt unprepared for handling these tasks. A possible explanation for this might be that the participants may have not subconsciously considered about the administrative aspects of their roles during the interviews as some components of it such as annual reviews and bonus usually occur only periodically. They aren't necessarily a priority in their day to day activities

Overall, the findings suggest that engineers tend to develop a wide set of new skills in order to be effective in their new roles as managers. These can be broadly categorized into 5 major areas: people management, communication, resource management, strategic thinking, and administrative skills. Throughout the findings, it is evident that participants often find themselves being technically sufficient for their new roles but notice a gap in their skillset concerning one or more of the above areas.

4.4 Research Question 4

Over the course of transition, engineers reported facing several kinds of challenges or difficulties. For most participants, these challenges stem from the difficulty of coping with the changes and new experiences associated with the transition. While not all changes identified were challenging, they characterized some changes as being difficult or challenging to navigate. In this section, we detail the changes and experiences that the engineers considered as challenging to navigate. Mainly, to address this research question, all participant data coded for challenges was

used for identifying the themes. And, for most part, the coded data for *challenges* was a subset of the larger coded dataset for *changes*. Hence, the data cross coded for both *changes* and *challenges* was used to contextualize and identify the themes. Table 4.5 provides an overview of the change themes identified from sections 4.3 and 4.4. and those that were considered difficult by the participants. Since, the objective of the research question is only to identify the challenges, the prevalence of the challenges experienced by the transitioned managers are not discussed. It is also important to note that, a difficult or challenging change does not mean that it is consistent across all participants. Mainly, the themes are highlighted as challenging, if at least even one participant who experienced the change characterized it as either “difficult” or “challenging” or a “struggle”.

Table 4.5. Summary of challenges faced by engineers during the transition process.

Individual Changes		Challenging or Difficult (Yes/No)
Social and Relational Changes		
	Interactions and relational changes with peers	Yes
	Lifestyle changes outside of work	Yes
	Increased exposure, visibility, and recognition in social groups	No
Psychological Changes		
	Work-role identity changes	No
	Changes in self-confidence	Yes
	Increased emotional burden	Yes
Cognitive Changes		
	Change in mindset from doing to delegating	Yes
	Focus Shift from individual tasks to big picture thinking	Yes
	Changes in role expectations	Yes
	Changes in job skills	Yes

	(People Management, Communication, Resource Management, Strategic Thinking and, Administrative)	
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Barring two types of changes, namely the increased exposure, visibility and recognition in social groups and work-role identity changes, the rest of the change experiences were characterized as difficult or challenging by at least more than one participant. Specifically, for many participants, these challenges were significant in the initial stages of their transition. Further, developing all the new job skills (RQ3) as noted in section 4.4. were also considered challenging by the participants.

4.5 Summary of Findings

In this chapter, findings corresponding to both my primary research question (RQ1) and my secondary research questions (RQ2, RQ3 and RQ4) are presented. Mainly, findings for RQ1: How do engineers experience work-role transition as they advance into engineering managerial roles? are presented in two phases. In the first phase (section 4.1.2) the transition experience of each individual is presented as a thematic narrative. These narratives provide a holistic overview of the 16 participants' individual and unique experiences of transition. In phase 2, thematic findings corresponding to the commonalities in transition experiences across the 16 participants are presented. In phase 2, a framework representing the participant schema of transition is also detailed. This is followed by accounts of themes and sub-themes corresponding to the transition experiences including: participant personal situation (mainly career progression), motivation to transition, preparation and learning experiences, organizational factors and support, descriptions of onboarding are all presented. The transition experiences relevant to the secondary research questions aren't discussed here.

In sections 4.2, 4.3, and 4.4, the thematic findings corresponding to the secondary research questions are presented. Namely, the changes experienced by the participants, the new job skills considered as essential for the transition and challenges associated with the transition are presented. Themes and sub-themes relevant to the corresponding secondary research questions are discussed in detail. In Chapter 5, the findings are further discussed in the broader context of the study. Mainly, in Chapter 5, I will be discussing the findings in relation to prior literature and outline directions for future research. I will also be discussing implications of the findings to various stakeholder

groups including engineering educators, engineering professionals and students, and HR professionals.

5. SUMMARY, DISCUSSION, IMPLICATIONS, AND CONCLUSION

This chapter presents a brief overview and a summary of the dissertation, followed by discussions on findings relevant to the research questions and emerging findings on gender and diversity issues. Later, I discuss the implications of the findings for engineers, engineering educators, and industry affiliates. I then describe plans for disseminating the study results, future work to conclude my reflective thoughts.

5.1 Summary

The research study's objective was to investigate the holistic and lived experiences of recently transitioned engineering managers. To this end, the study addressed the following primary and secondary research questions.

Primary Research Question

RQ1: How do engineers experience work-role transition as they move into engineering managerial roles?

Secondary Research Questions

RQ2: What personal changes do engineers experience as they transition into engineering managerial roles

RQ3: What new skills do engineers perceive as critical for their survival and success in their new roles?

RQ4: What challenges or difficulties do engineers face as they transition into managerial roles?

The study employed a qualitative interpretive methodology to uncover the recently transitioned engineering managers' lived experiences in line with the research objective and the research questions. The study focused on participants from a single telecom company, and the data for the study came from semi-structured interviews with 16 recently transitioned participants from

the company's engineering divisions. The data analysis to address the primary research question was done in two phases. In the first phase, individual narratives were drafted, highlighting the participants' profiles, demographics, and the critical incidents of their transition journeys. In the next phase, a thematic analysis was conducted to identify themes cutting across the interview transcripts. A single-phased thematic approach was followed to identify themes corresponding to the secondary research questions. In the following sections, I discuss my thoughts and conclusions on findings related to the primary and secondary research questions.

5.2 Discussion: Research Question 1 (RQ1)

The findings for the primary research question were organized into two sections consistent with the two-phased data analysis approach. First, I presented third-person narratives for all 16 participants. These narratives provide detailed demographic and background information, as well as context for the research objective: to investigate the holistic experiences of recently transitioned engineering managers. These narratives also describe the participants' unique transition experiences interspersed with their own voices. At the end of the narratives, I also present a general framework (refer Figure 4.1) that represents participants' transition experiences, followed by common themes of experiences related to the primary research question.

The transition framework is developed from a cross narrative analysis of the participant interviews. The framework describes the participants' transition process in three major phases: First, the motivation or a trigger for transition, followed by experiencing the transition, and then finally settling or onboarding into the new role. Moreover, there is learning and preparation that occurs throughout the transition process. There is also an interplay between internal factors (e.g., personal situation, demographics, etc.) and external factors (e.g., organizational policies, support, etc.) that majorly impact the transition process. Some of the significant aspects of this transition framework map onto the transition schema of senior leaders moving from the private sector to the nonprofit sector, as described by Goebelbecker (2008). In summary, Goebelbecker describes the transition process for the senior leaders as a flow "beginning with the decision to enter the nonprofit sector, making the actual transition, and then the experience in the nonprofit." (P. 160).

The findings also suggest that engineers often find the transition difficult, especially during the initial stages. This period of sudden shock often occurred in the first six months of the transition for most managers. This phase was also described as a learning-intensive period for most

participants. Following this phase is often a phase of adjustment. This is usually between the first and second years of the transition. Finally, after spending a considerable amount of time in the new role – typically around 2 to 3 years – participants seemed to feel more settled. These findings resonate with some of the central principles of the general transition framework described by Nicholson & West (1988). More specifically, they propose transitional stages of encountering shock, personal adjustments, and stabilization that are consistent with the engineer to manager transition experiences. However, the engineer to manager transition framework deviates slightly from Nicholson and West's model in terms of the preparatory phase. Whereas in their model, the preparatory phase is considered as the first stage in the transition process, the engineer to manager framework described in this study views the preparatory phase as a more continual process rather than a distinct first phase of the transition. Specifically, the preparations for engineers transitioning into managerial roles begin very early on in the transition process and continue throughout the transition.

Following the narratives and the transition framework, I present the common thematic experiences of transition for the participants. These themes suggest that several internal and external factors significantly impact the transition process for individuals. The findings are congruent with the 4S transition framework described by Schlossberg et al., (1995). Mainly, the engineer to manager transition demonstrates strong evidence of how the self, situation, and support impact the transition. First, regarding the aspects of self, the participants' personal characteristics, such as gender, age, psychological state such as their self-confidence, etc. seem to influence the participants' transition. For instance, the transitional experiences of the female participants, Rene and Lily, were distinct from those of the male participants in many ways. These variations in experiences are further discussed below (section 5.6).

Second, in terms of the situation, including the number of years spent as individual contributors, their current career stage, etc., influenced how and when the engineers decided to transition into managerial roles. For instance, most engineers often spend a long time in their careers as individual contributors before deciding to move into managerial roles. Consistent with Howard's findings, who stated that engineers spent an average of about 17 years before the transition, the participants in this study spent close to 18 years before transitioning into managerial roles. After spending so many years as individual contributors, most participants felt like they hit the ceiling in terms of career progression and did not find many options to grow further. Moreover,

many participants made the decision to transition as they felt their personal situation, be it their age, their current career situation, etc., mandated a lateral move into the managerial role. It is also interesting to note that participants whose motivation for transition were driven by a keen interest in a management career path moved into the managerial roles a little earlier in their career as opposed to those who were triggered by the lack of growth opportunities. This is particularly evident from the experiences of Kevin, Seth, and Scott. All three of these participants reported that their transition stemmed from their intense desire and interest to move into the world of management, having spent the least number of years (10-15 range) as individual contributors compared to their peers with different trigger points. Not surprisingly, these three participants also described the transition process as relatively easier for them.

Third, the organizational policies and supports, including the company's training programs, the attitude and support from the management, and mentoring opportunities, all bolstered the individuals' transition process. Individuals explicitly sought out and strengthened their relationships with mentors and their previous managers. These relationships proved helpful for them throughout the transition process, as they were able to learn both the formal and informal aspects of the managerial world through these mentoring relationships. Other researchers, such as Korte (2007), also emphasize the role of high-quality relationships formed with managers and mentors for newcomers to learn and socialize into new roles.

Additionally, the findings suggest that a lack of organizational support can impact the transition process. For instance, a vast majority of the participants expressed a desire to continue working as technical contributors if they were given more opportunities to grow within the technical ladder. However, since the company did not have policies to accommodate career growth beyond level 4 (refer to section 1.4) on the technical ladder, many engineers were constrained to seek out managerial opportunities. Moving into the managerial role without a keen interest in management made the transition difficult and challenging for many of them. Also, despite no evident salary and pay differences between the highest technical level (level 4) and the company's managerial role, most engineers associated the managerial role with higher credibility and bigger responsibilities. Based on the participants' experiences with the dual career ladder, I argue that the company's policies surrounding the career pathways significantly impact engineers' transition process. Mainly, the flexibility offered in the technical ladder and engineers' perceptions of the managerial role compared to the technical roles all impact when and how engineers' transition into

the managerial roles. Further, the inefficiencies in implementing the dual ladders may also attract people into the managerial role for the wrong reasons, leading to difficult transitions. These inefficiencies could stem from either the companies' inability to provide equal opportunities for both paths or from employees' views of perceived lack of fairness and equality of the technical ladder as compared to the managerial ladder. While Hoffmann et al., (2016) examined the relationship between perceived equality of technical ladders, the transparency in the dual ladders, and career satisfaction, further research is needed to uncover better practices and policies for implementing an effective dual ladder policy for engineers and other technical professionals.

Next, the analysis of the participants' experiences of transition reveals that strategies are a critical part of coping with the transition process. The participants often reported their use of various coping strategies to adjust to the changes and challenges associated with the transition process.

5.3 Discussion: Research Question 2 (RQ2)

The study was motivated by the expectation that engineers experience personal and individual changes as they transition from engineer to manager roles. This claim is substantiated by the findings, which suggest that engineers do indeed experience several changes during the transition at times, affecting their lives both at and outside of work. These findings are in accordance with prior research that proposes people experience personal and individual changes during a major career transition (Goebelbecker, 2008). Hence, it is not surprising that engineers transitioning into managerial roles perceive to have experienced several personal and individual changes due to the transition.

As Anderson (2009) notes, the majority of work-role transition studies have dealt with exploring transitions from either a social/relational perspective or a psychological perspective of an individual. However, he further argued that the cognitive aspects of the individual are critical to uncover the holistic transition experience. Aligned with these prior studies, the change experiences identified in the study are classified and presented as three major categories. First are the individual changes associated with the sociological/relational aspects of the transition. These include relational changes at work, lifestyle changes outside of work, and perceived status and recognition changes in social groups. Second, many changes are associated with the psychological aspects. These include changes in work-role identity, changes in self-confidence, and an increase

in emotional burden. And third, there are changes concerning the cognitive aspects of the individual. These include changes in mindset from doing to delegating, changes in perceptions of the managerial role, a shift in focus from individual tasks to big-picture thinking, and developing new skills. These myriad changes experienced by the engineers suggest that the transition process significantly alters the individual in many ways.

Goebelbecker (2008) who examined the transition process of senior leaders moving from private to nonprofit sectors, proposed that individuals experience changes due to a work-role transition process. Further, his findings state that individuals in work-role transitions may experience changes in "self-confidence, work-role self-identity, career motivation, staff interactions, job function, lifestyle, and relationships" (p.160). Although the nature of the transitions studied by Goebelbecker is different, the change themes identified in the engineer to manager transition significantly overlap with Goebelbecker's findings. Specifically, the common categories from both studies include changes in self-confidence, work-role identity, staff interactions, and lifestyle and relationships. However, cognitive changes identified for the new transitioned engineering managers such as focus shift from individual to big picture thinking, from doing the tasks to delegating the tasks etc. are visibly absent from Goebelbecker's findings. The minor differences in the categories of changes can be well attributed to the distinct nature of the transition of the two studies. While the way of experiencing the changes may be different owing to the different nature of the transition among participants in the two studies, the findings suggest that there may be a commonality in the kinds of changes experienced by individuals in a major work-role transition. However, further research is needed to theorize and conceptualize the general and specific types of changes experienced by individuals in a work-role transition.

The findings also indicate that individuals perceive changes as both positive and negative, as summarized in Table 5.1. The table only provides an overall tendency for how individuals describe and reflect on their change experiences but do not delve into how each participant perceived the change in an absolute sense. For example, change experiences are considered positive if they lead to favorable outcomes or positive development for the participants in general. Conversely, change experiences are classified as negative if they are undesired or lead to dissatisfaction. In addition, the change experience was perceived as neutral if there was no significant positive or negative outcome associated with the experience. It is affirmative to see that individuals do not perceive all changes associated with the transition in a negative light.

Consequently, these findings raise the question of how organizations and individuals can focus on the positive change experiences to make the overall transition more pleasant.

Table 5.1. Participants' Perceptions of Changes Associated with the Transition.

Changes associated with the engineer to manager work-role transition	General Change Perception
Interactions and relational changes with peers	Negative
Lifestyle changes outside of work	Negative
Increased exposure, visibility, and recognition in social groups	Positive
Work-role identity changes	Neutral
Changes in self-confidence	Positive
Increased emotional burden	Negative
Change in mindset from doing to delegating	Negative
Focus shift from individual tasks to big picture thinking	Positive
Changes in role expectations	Negative
Changes in job skills	Positive

5.4 Discussion: Research Question 2 (RQ3)

One of the changes experienced by the individuals in transition include changes in job skills. Specifically, engineers had to learn to develop new skills to survive and succeed in their new roles. Many participants felt they had appropriate technical expertise for the new role but felt inadequate in dealing with the social skills required for the job. They demonstrated an awareness of needing soft skills to deal with the managerial and leadership aspects of their new role. The findings presented in the study reveal five categories of such social skills and competencies that the engineers described as essential for their new roles. These include people management, communication, administrative, resource management, and strategic thinking.

The findings indicate that while experiencing the transition, individuals also employ several strategies to cope with the transition changes. While direct comparisons of these skills with

prior studies are difficult owing to the different typologies used by authors to describe skill sets, the findings somewhat compare to prior literature emphasizing the need for engineers to develop soft skills, including working with people broadly. In the following table (Table 5.2), I attempt to compare the skills identified in the study to prior work, including Wallace (2016) and Badawy (1995). Only those skills that overlap with the current study are highlighted in the table. The complete list of skills identified by other literature sources is discussed in detail in the Literature Review chapter.

Table 5.2. Overview of Comparable Overlapping Themes for New Skills.

This Study	Wallace (2016)	Badawy (1995)
People Management	Teamwork, Conflict Management, Coaching	Interpersonal
Communication	Communication	Interpersonal
Resource Management	Time Management	Administrative
Strategic Thinking	Strategic Decision making	Administrative
Administrative	Planning and Administration	Administrative

While most of the skills identified in the study have comparable overlap with prior studies, the different ways in which the skills are classified and categorized makes it challenging to compare literature sources. For example, I define resource management as the skills required to manage time and human resources. In this study, I also highlight the skills required to identify and develop the right person for the right job under resource management. While Wallace (2016) recognizes the importance of time management, he does not delve into the aspects of managing human resources. Additionally, Badawy talks about aspects of resource management as administrative skills. Such inconsistencies are evident in findings across studies. It is also important to note that skills described by Wallace (2016) as essential transitional skills, including and related to global awareness, self-management, diversity, politics are absent from the study's findings. These inconsistencies could be attributed to many things. First, the study's objective is only to explore new skills that the participants' recognized as essential and worked towards developing for the managerial role. Hence, it does not cater to the exhaustive lists of skills that may be essential for the role. Second, the organizational context also plays a role. For example, Wallace's findings are representative of a study conducted in the South African context. Hence,

the global context and differences in organizational settings may lead to differences in attributes. Third, the differences in typologies used to classify skills vary widely. For example, the role of self-management was identified as critical for managerial transition in this study. However, it was discussed as a change in dealing with the increased stress and needing to develop self-confidence and thus was not listed under the new skills needed to develop. Four, the source of the data for the study leads to variations. Whereas the data for this study comes from 16 engineering managers employed by a telecom company in the USA, Wallace's study deals with 16 managers in South African companies, and Badawy does not provide any sources for his study.

5.5 Discussion: Research Question 4 (RQ4)

Many engineers find it difficult to transition from a technical contributor to a managerial role. The study findings illustrate that this difficulty often stems from dealing with the myriad changes they experience as a part of the transition. This section presents the themes of difficult and challenging change experiences and compares them with findings from Howard's study. Although Howard (2003) did not present his challenging experiences as changes experienced by the individuals, there is still some notable overlap of findings from the two studies. Table 5.3 presents the challenges identified from the study and how they compare to Howard's findings.

Table 5.3 Comparing Challenges Identified in this Study with Howard's (2003) Findings.

Challenges identified in this study	Comparable challenges identified in Howard's study
Interactions and relational changes with peers	Relationship Changes
Lifestyle changes outside of work	Resources and getting the work done
Changes in self-confidence	Not Applicable
Dealing with an increased emotional burden	Increased stress and pressure associated with increased responsibility
Change in mindset from doing to delegating	Delegation
Focus shift from individual tasks to big picture thinking	So much going on
Changes in role expectations	Choosing the management career path
Changes in job skills	Developing new skills

The following sub-section presents detailed descriptions of the similarities and differences identified in the table.

1. Interactions and relational changes with peers: Howard calls this *Relationship Changes*. Howard also identified changes in new managers' relationships with their peers who no longer share the same job level as one of the most difficult challenges.
2. Lifestyle changes outside of work: Howard indirectly mentions lifestyle changes as he talks about managers needing to work extra hours. This indirectly hints at the work-life imbalances caused by the managerial transition. Howard talks about this difficulty under the theme titled *Resources and getting the work done: finding the time, the staff and other resources to get it done*.
3. Changes in self-confidence: There is no clear mention of this challenge in Howard's study.
4. Dealing with an increased emotional burden: This difficulty relates to the *Increased stress and pressure associated with increased responsibility* theme identified by Howard.
5. Change in mindset from doing to delegating: Considered as one of the primary challenges faced by recently transitioned engineering managers, Howard describes this difficulty at great length under the theme *Delegation: The challenge of leaving the hands on technical behind and learning to work through others*.
6. Focus shift from individual tasks to big picture thinking: This challenge is discussed in the theme *So much going on: The engineering manager role involves balancing many more responsibilities, tasks and priorities than the engineering role*. Mainly, Howard discusses the difficulty experienced by new managers as they change from a single focus to a broader managerial focus.
7. Changes in role expectations: Howard describes the difficulties stemming from a mismatch in expectations and reality of the role under his theme titled *Choosing the management career path: the concerns before deciding and questions experienced during or after the transition*.
8. Changes in job skills: This difficulty maps onto Howard's *Developing new skills: Discovered the need for a new set of skills as a manager* theme. Under this theme,

Howard only caters to managers' need to develop the people, administrative, and communication skills. The theme does not focus on the difficulties associated with needing to develop strategic thinking and resource management. However, under the *Resources and getting the work done* theme, Howard refers to the aspects of resource management. There is no evident link to the difficulty in needing to develop strategic thinking, however. The organizational context could be a reason for the absence of this difficulty. In contrast to the Tel company, some companies may not require strategic thinking of their first-level managers.

It is also important to note that contrary to the study's findings, Howard highlights dealing with administrative aspects as not challenging for the transition. This difference may be attributed to the different ways in which administrative tasks are defined. Whereas Howard describes administrative tasks such as running meetings, creating agendas, and using new software tools, in this study, these include aspects such as conducting a performance review of direct reports, approving pay scales and salaries, etc. Not surprisingly, doing performance reviews, approving pay scales and salaries, and other related administrative tasks seem challenging for engineers as they are not well prepared or trained for such tasks. Some participants even expressed reaching out to their mentors for seeking help to develop these difficult administrative skills. Additionally, it is also important to note that only three participants in this study talked about the difficulty in dealing with administrative tasks and needing to develop those skills. Since it wasn't very prevalent in this study, a visible lack of this theme in other studies doesn't seem surprising.

Overall, the comparisons suggest that there is a significant overlap between the two studies. Barring a few inconsistencies in the specifics of the difficulties experienced, they are consistent with the experiences highlighted by Howard. However, unlike Howard's study, I do not delve into ranking the challenges based on the difficulty level. Since the study's objective is only to identify the challenges or difficulties associated with the transition and not be concerned with the most difficult challenges, I only identify and present the challenges identified by the participants. Further research, similar to Howard's study, could shed more light on the difficulty level of the challenges.

5.6 Gendered Voices

Although the research questions for this study do not specifically allude to the notion of gender and diversity in transition experiences, the findings are consistent with the literature on experiences of women and other minorities in STEM professions. Despite my intentional efforts to recruit a gender diverse group of participants for the study, I was able to recruit only three female participants alongside 13 male participants. However, the HR managers who supported me with the study's data collection efforts confirmed that this ratio of women to men in managerial positions was a typical representation of the company's engineering managerial population. The HR managers also suggested that there are fewer women in the engineering domain than men and even fewer who end up in managerial positions. This attrition, combined with my participant selection criteria, yielded only three female participants. This gender disparity and disproportionate male representation in STEM fields and professions echo sentiments on prior literature on women in STEM professions (Fealing et al., 2015; Sassler et al., 2017). Further, research suggests that men tend to move higher up and faster in their careers than women in all professions, causing a wider gender disparity in management roles (Cater & Silva, 2010). Not surprisingly, the inequality in representation is much more dominant for women in STEM professions transitioning into managerial roles.

As a researcher and an advocate for gender equity in STEM, this low representation of women participants further propels me to "shift the default" away from generalizing my findings on my predominantly male participants' transition experiences to other demographics (Pawley, 2017). Instead, I attempt to highlight any anomaly that speaks to gender and diversity as a part of my research. To this end, drafting and presenting all the participants' narratives helped me give voices to each unique individual and their journey of transition. However, as I was preparing the narratives, I realized that the transition experiences of one female participant, Rene, were unique and distinct from her male counterparts, compelling me to further highlight her experiences. Mainly, Rene's narrative depicts the several challenges and biases faced by many women and other minorities in the workplace. For instance, Rene's transition experiences are underscored by her feelings of being an imposter or inadequate. These are evident throughout her transition narrative. The following sections highlight some of these many imposters experienced by Rene at different stages of the transition from motivation stage to preparations to even after she has made the transition.

For example, she credits her managers and mentors for believing in her abilities and "grooming" her into a good manager and a leader. Rather than acknowledging her strengths, abilities, and decisions, she attributes her advancement into the management role to her managers. As she states: "they saw something in me that I did not even actually see for myself, and they, unknowing to me, groomed it." This experience is also like one described by another female participant, Lily, when she talks about how her managers "groomed" her to become a manager and pushed her into the managerial path. While the support of managers in the transition process has been a common theme across genders, only Rene and Lily's experiences speak to the extent of influence the managers have on their career decisions. From "being groomed" to being told that the managerial pathway was the right fit for them, their career decisions seem to reflect less of their own desires and decisions. This is further demonstrated as Lily, in another instance, acknowledges her desire to continue in the technical pathway if the right opportunity was presented.

In other instances, once Rene has made the transition, she also struggles with displaying authority as a manager. For example, Rene made deliberate attempts to abide by her policy to "not sit on a pedestal over her team." Instead, on other occasions, she admits to "playing dumb" and asking basic questions as a strategy in team meetings to elicit richer information from her team members. She even goes so far as to say that she was okay with people thinking that she was dumb or even disliked her for asking so many questions so as long as it facilitated conversations in the meetings. This resonates with "The Tightrope" bias described by Williams et al. (2014) that points to the struggle faced by women as being perceived as "too feminine to be competent" or "too masculine to be likeable" (p.3). In another instance, she further demonstrates struggling with walking "the tightrope" as she acknowledges needing to navigate being humble (i.e., a characteristic typically viewed as feminine behavior) and portraying more confidence (i.e., a characteristic typically viewed as masculine behavior). She believes that her authentic self as a humble person often comes in the way of her being a confident leader and a manager.

Next, Rene also demonstrates the urge to prove her capabilities as a leader and a manager quite strongly. For example, in one instance, she wanted to prove and demonstrate to her managers and mentors that she was capable of being a leader. She demonstrates this urge to be a good leader and the right person for the managerial role to deem worthy of and justify her managers' trust and investment. This experience conforms to the prove-it again bias described by Williams et al.

In addition to these imposters, Rene also struggled with managing work and additional managerial responsibilities. She talked about the struggles of dedicating the same amount of time with her kids and family as a manager. Research shows that women are often expected to do "second shifts," taking additional responsibilities at home, leading to a roadblock in their careers (Ballakrishnen et al., 2018). However, Rene was able to manage both house and work responsibilities efficiently. Although difficult at first, she started planning things around her familial priorities and worked late hours with more efficiency to create her desired work-life balance. This aligns with prior literature that suggests that women scientists with children are often more efficient than their colleagues (Williams et al., 2014).

Rene's, and in part Lili's, experiences transitioning into the managerial roles resonate with the literature on challenges and biases faced by women and other marginalized groups in STEM professions (Ross, 2016). Specifically, women and other minorities are known to be plagued by imposter syndrome or the feeling of not being good enough, particularly in STEM fields (Collins et al., 2020; Lindemann et al., 2016). This seems to magnify further as women move higher up the career ladder into technical, managerial roles.

5.7 Implications and Recommendations for the Engineering Education Community

The study provides both academic and practical implications for the engineering education community. Primarily, the study adds to the knowledge of engineering practice and research by delving into engineering professionals' lived experiences in the real world. It also reports on the needs, challenges, and difficulties faced by engineering managers. These experiences further paint a composite picture of the socio-technical nature of engineering practice. This is in accordance with prior research on early career engineering practice that asserts that the engineering profession is socio-technical in nature (Jesiek et al., 2017). In fact, the findings from prior literature also suggest that these social aspects become more pronounced in the later stages of an engineer's professional career (Jesiek et al., upcoming). Engineers are often mandated to distance away from the hands-on technical work and take upon more managerial and leadership responsibilities. In turn, these responsibilities require them to "work with people" or "manage to get the technical work done through others." This alludes to the pressing need for engineering educators to underscore and integrate the social or sociotechnical aspects into curricula that are often primarily focused on technical learning.

As for the practical implications, the findings offer specific benefits to engineering educators and faculty responsible for developing engineering managers. These implications would be beneficial to all engineering educators developing and conducting workshops, seminars, or even courses. First, they could leverage the skills identified in the study (section 4.3) and integrate them into the curriculum for engineering management programs that seek to develop engineering managers. These include:

- **People Management:** People management includes all aspects of working with people required for new engineers. These include a sub-set of skills such as motivating team members, empathy, ability to manage conflicts, influencing, and negotiation skills, all of which are considered as critical for engineering managers to develop.
- **Communication:** The study identifies technical communication as an essential skill required for managers. Mainly, managers need to develop the ability to communicate technical information to various audiences. Particularly, they need also to learn to synthesize the technical information and provide a technical overview to the senior management in a way that makes the most sense to the business. In addition to executive and technical communication, participants also emphasized the need for developing informal communication skills such as listening. (Trevelyan 2014, Chapter 6) in his study also emphasizes the need for engineering programs and courses to focus on skills such as listening, reading, and seeing, along with aspects of technical communication.
- **Administrative Skills:** These include aspects such as conducting performance reviews, or approving pay scales and salaries, the ability to evaluate employees and give appropriate bonuses, etc. These would be essential skills to develop for managers as they take upon additional people responsibilities.
- **Resource Management:** A manager is usually responsible for managing several people and projects. Given this norm, it is useful for managers to develop the skill to manage resources, resources, both time and human resources. Managers also need to be adept at recognizing the right talent for the right job. Overall, these skills bucketed as resources management are essential for managers to develop.
- **Strategic Thinking:** Managers are often required to think about the value they bring to the company and not just about the deliverables. This needs managers to develop

strategic thinking or the ability to think in terms of the impact and value creation for the broader team and the company.

However, since most of these skills, although social in nature, are embedded in a technical context, educators must be cautious while offering siloed approaches to developing these professional or social skills. Rather, educators must leverage project-based and case-based skill development learning experiences so as to develop the required socio-technical skills. While engineering professionals at more advanced levels such as those pursuing Masters' in Engineering Management related programs could benefit directly from such an integrated curriculum, it could also be of value for engineers currently pursuing bachelor's degrees. Exposure to management related concepts for engineering students at the bachelor's level could, in fact, help them for the socio-technical nature of engineering practice from a very early stage.

Besides, engineering educators can also leverage the narratives documented in the study to present a more realistic picture of the engineering managerial practice to future engineers. These narratives could be used as complementary reading material to enhance students' understanding of the practice.

5.8 Implications and Recommendations for Engineers Aspiring to Become Managers

The study has many pragmatic implications for engineers looking to transition into managerial roles. Based on the findings and the advice offered by the participants of the study, I recommend engineers to seek out the following learning/preparatory experiences:

- **Informal Leadership Opportunities:** Seek out as many informal leadership and managerial opportunities as possible as a technical contributor. These could include volunteering to mentor others or taking upon additional responsibilities as a team lead for a project, or initiating a project to create value for the company. The findings suggest that nearly all participants benefited from seeking out some sort of prior informal and/or smaller scale leadership experiences. These experiences not only helped them with the transition process but also substantiated their profile as a future leader. Seeking out and volunteering for leadership activities helped participants be recognized by the senior leaders.
- **Leadership Development Programs/Education:** Even prior to the transition, avail and participate in any leadership development program and training and development

programs offered by the company. These programs could offer better insights into management in general. At times, these programs could also provide opportunities to network, connect, and learn from other people attending the programs. In addition, participants could also develop their leadership skills by seeking courses and/or education outside of the company. This could be done by either enrolling in individual courses, certifications, or even an MBA program. While an MBA program may not be suited for everyone due to monetary and time constraints, the three participants in the study who completed part time MBA seem to have benefited from the program as it prepared them for the strategic, budgetary, and people management aspects of the new role.

- **Mentorship:** Seek out and strengthen relationships with prior managers and/or other mentors willing to help and guide. The findings from the study suggest that engineers who sought out strong relationships with mentors and other managers benefited a lot both prior to and during the transition process. Mainly, they were able to discuss and learn how to navigate both informal and formal challenges and changes associated with the transition. In most cases, since the managers were more experienced in the transition process and role, they were able to guide the engineers through difficult situations. However, it is also important to note that you should not be afraid to ask for help and/or not feel shy to ask questions.

Also, engineers would benefit from gaining a better understanding of what the managerial role entails as well as the general transition experiences of changes and challenges before deciding to transition. To this end, the narratives, and the themes of changes, challenges, and new skills associated with the managerial role that are identified in the study can serve as a basis for enhancing engineers' understanding of the managerial role and the associated transition.

5.9 Implications and Recommendations for Tel Corp and Other Organizations

The findings provide insights and suggestions for companies, including Tel Corp, to enhance their leadership pipeline. The following are a few recommendations for organizations and HR professionals to help better retain, promote, and develop their engineering talent into effective managers and leaders:

- **Dual Career Ladder:** Implement effective dual career ladder policies and systems in the organization. This can be done in many ways. First, companies could identify and promote engineers interested in the management pathway early in their careers rather than wait till they have exhausted their opportunities within the technical stream. As suggested in this study, transition into management is difficult for engineers who have stayed longer in the individual contributor roles as compared to those who have made a move early on. Second, companies could gauge the motivation of engineers before moving them into managerial pathways. The study's findings suggest that engineers who move into management without any interest in the field face a difficult transition process. This may also lead to low engagement and low productivity among the employees. Next, companies should make an effort to ensure both the technical and managerial pathways are perceived as equal. While companies may have policies supporting some technical and managerial roles at the same pay levels on paper, employees may still consider and perceive managerial roles as being higher level than their corresponding technical level. These perceptions often trigger technically inclined engineers to move into management for a scope at better opportunities and thereby attracting the wrong candidates for the managerial jobs. Hence, promoting a culture where both technical and managerial roles at the same level are treated and viewed as equal opportunities can improve the managerial pipeline.
- **Continued onboarding and training support:** Provide onboarding and/or training programs to help engineers before and during the transition process. Findings suggest that it typically takes around 2 or 3 years for engineers before they finally feel settled in their new roles. Engineers also felt the need for some kind of organizational support throughout this process. Usually, as in the case of Tel company, organizations may only provide onboarding programs that support individuals for just the initial period of the transition process. However, as demonstrated from the study, engineers need support beyond the initial stages of the first three months when the actual learning or adjustment occurs. In the later stages, after the initial phases of shock and surprises, engineers start to learn and develop new skills required for the new job. Organizations may also provide support in developing these new skills, including the social and professional skills mentioned above. These could include a) encouraging and/or supporting engineers to

pursue an MBA or related courses, b) offering rotational development programs for engineers before the transition so as to help them develop broader knowledge and skills necessary to work across groups and divisions, c) offering workshops, training content especially focused on people skills such as negotiation, motivating teams etc.

- The attitude of senior management: Findings suggest that current management's attitude and encouragement play a great role in developing engineers into effective leaders and managers. Mainly, participants whose managers were supportive and encouraging of the engineers demonstrated an easy transition. To this end, I suggest that companies create a more consistent culture among their management to encourage and develop more engineering talent into managerial roles.
- Promoting a culture of diversity and inclusion: Companies can create a culture of diversity and inclusion to help promote more women and other marginalized minorities into engineering managerial roles. Furthermore, companies could also offer more support to women and minorities during the transition process as their experiences may be more challenging than their male counterparts. Companies could organize employee resource groups (ERGs) for women leaders across all departments where they can network and learn from one another. This could also be a safe place for these women and other marginalized minorities to discuss challenges or difficulties that they might be facing in their job roles. Since the proportion of women leaders in STEM tend to be very low, organizations can also make efforts to forge connections with ERGs in other companies, and other women support groups. As Ross (2016) suggests, such employee resource groups often help “new hires gain social integration” (p. 313) and are especially valuable for women and other marginalized communities.

5.10 Benefits to the Participants

In addition to the implications and recommendations to the engineering educators, engineers looking to transition, and HR professionals and companies, I believe the participants also benefited from the study. Many participants reported appreciation for having opportunities to reflect on several aspects of the transition process, including their strengths and gaps. As one participant noted, "I think this conversation has definitely helped me reflect on my transition experiences and learning needs." In some cases, the interviews also helped them identify the

changes that they have been experiencing and how best to cope and adjust to them. For some participants, this study also provided an opportunity to share their insights with engineers looking to transition. Mainly, as another participant stated, "The information that you're collecting will be helpful for the individual contributors who want to move to a managerial role." Moreover, nearly all participants expressed an interest in receiving a summary of the findings to help them further reflect and analyze their transition process and growth areas.

5.11 Future Research

Through this study, I hoped to uncover the holistic experiences of recently transitioned engineering managers from a work-role transition lens. However, to further the study and address some of the questions and limitations that have come up over the course of the dissertation, I envision the following research studies as potential follow-ups:

1. This study included participants from a single telecom company. To address such a limitation of conducting a single organizational study, I envision future research replicating the study across various organizations. This may shed better insights into understanding the experiences of engineers in transition across various organizational contexts and industries.
2. This study aimed to uncover the experiences of the transition process through a qualitative interpretive lens. Future work employing quantitative methods may be used to identify and generalize findings to a larger population. Further, findings of transition experiences could also be compared across different organizational industries, settings, demographics, etc.
3. Further, the study's findings suggest that the transition experiences for women engineers could be particularly challenging. The current study is limited by data from only three female participants. The study also does not delve into details of the race and ethnicity of the participants due to organizational restrictions during the data collection process. These factors may also significantly impact the transition experiences for engineers. Hence, to address this limitation, I suggest future studies focusing on the experiences of women and other marginalized groups. Such studies could shed more light on the challenges faced by marginalized groups in managerial transitions. Moreover, feminist and critical theories can be leveraged as a lens to uncover these experiences.
4. The study can additionally be expanded by considering the perspectives of other organizational stakeholders such as the senior management, HR managers, and the mentors

of the individuals in transition. These perspectives, complemented by the individual perspectives of the managerial transition experiences, can provide a more holistic purview of the organizational transition process. Since the individual transition process is heavily impacted by organizational factors such as the senior management, HR professionals, and supervisors in the company, a study including the perspectives of these other stake-holders would provide a better understanding of the phenomenon of transition within a company.

5. The study examined the transition experiences from a work-role transition framework. There is scope to reevaluate the study using other relevant frameworks such as social cognitive and learning theories, social identity theories, and the like. Leveraging these theories to the study might generate new insights. For instance, a social cognitive and learning theories could help provide more in depth answers to questions related to how engineers learn to become managers and how organizations and other educational institutes can better help them learn to become better managers and leaders.
6. There is also scope for future studies to uncover the transition experiences of engineers moving into informal managerial roles. While this study focused on engineers transitioning into formal managerial roles, the findings suggest that engineers experience some sort of informal managerial roles very early on in their careers. There is scope to uncover engineers' transition experiences into informal managerial roles and compare those results with the transition experiences into formal managerial roles. In addition, there remain opportunities to consider and include participants who have an unconventional pathway into management. For example, as noted in the limitations section in Chapter 1 (section 1.5), there could be engineers hired into managerial roles straight out of engineering graduate school or those that move in and out of engineering to settle in managerial roles. Future studies could investigate such transition experiences.

5.12 Dissemination

To maximize the study's impact, I plan to disseminate the findings to both industry and academic audiences. To the end of translating research to practice, I envision disseminating the findings in many ways. First, I plan to conduct workshops and seminars to help companies develop their technical leadership pipeline. These workshops could cater to both engineering professionals seeking to advance in their roles as well as HR professionals working towards developing their

engineering talent. The objectives of these workshops would be to create awareness among engineering professionals of the realities of engineering management practice. The findings from the study suggest that the major difficulties for engineers transitioning into managerial roles stem from the lack of awareness of the socio-technical nature of engineering management. To this end, the workshops would aim to create awareness of the basic capabilities and strategies required for dealing with the social or people aspects of the managerial roles. The workshop would also specifically emphasize social capabilities such as leading people, motivating people, empathy, negotiating conflict, etc., that are found to be critical skills required by managers. I would also draw upon my prior research on socio-technical aspects of boundary spanning leadership, global competencies, and ethics for engineers to further enhance the workshop offerings. Mainly, leveraging these research experiences would help me better identify a more comprehensive list of strategies and competencies required by engineers to be successful managers and leaders in their future work.

Also, I intend to reframe the research findings to suit the pragmatic training and development needs of the companies. As a first step, I have already partnered with a company to inform them of the findings and the associated implications for their engineering leadership development program. Similarly, I also plan to present a seminar at a private forum of chief technology officers' group to discuss and share insight into the engineer to a manager transition and what organizations and HR professionals can do to support the transition process. I intend to do more such seminars and share best practices from what I have learned.

I also plan to share the 17 narratives, including the pilot interview narrative, with engineering education faculty, students, and engineering professionals planning to transition into leadership and managerial roles. Buswell (2017) suggests that narratives act as great learning resources for students to connect and learn from the experienced others. Hence, I plan to share these narratives and findings from the narratives with the larger community via blogs, workshops, or peer-reviewed publications.

APPENDIX A. INTERVIEW PROTOCOL

Part 1: Lived experiences (RQ1)

- 1) Can you tell me a bit about yourself?
- 2) Can you walk me through your current job role?
 - What is your title?
 - What division do you work for?
 - How big is your team?
 - What are your responsibilities?
 - How many people report to you?
- 3) Can you walk me through your journey to your current position, starting with your undergraduate experience? (Prompts only if needed; Potential follow-up questions down below)
- 4) How would you describe the transition from an individual contributor role to a technical managerial role?
- 5) How would you describe your preparations for the transition?
 - Did you have any previous leadership roles - informal or formal - that helped you with the transition?
 - Did you seek out for any informal/formal mentors that helped you with your transition?

Part 2: Specific experiences (RQ2, RQ3, and RQ4)

- 1) Can you describe your typical workday as an engineering manager?
 - What are your day-to-day activities?
 - What are the most favorite aspects of your job?
 - What are the least favorite aspects of your job?
- 2) How would you describe the changes associated with the transition to the new role, if any?
 - Changes observed in day-day activities
 - Changes related to identity, relationships, thinking etc. (Specific examples)
- 3) Can you think of the most rewarding work experience/project and/or assignment you have been in as a manager? (Critical incident approach)
 - What was the situation?
 - Who was involved?

Why was it a rewarding experience?

What was your role in it?

What strategies or skills did you use in the situation?

What was the outcome or resolution?

How might you do it differently next time?

- 4) Can you think of the most challenging work experience, project and/or assignment you have encountered as a manager? Preferably a resolved situation but if not, an on-going situations should also suffice (Refer to the question above for prompts) Critical Incident approach
 - If the participant does not recall or talk about a challenging situation, then consider probing for the most memorable experience as a recently transitioned engineering manager.

Part 3: Reflective responses (RQ 1, RQ2, RQ3 and RQ4)

- 1) How has your perception of the managerial role changed?
- 2) What advice would you give to individual contributors/engineers as they prepare to transition into a managerial role?
 - What learning experiences do you think would be useful for them?
 - What do you think are the essential skills or competencies that they need to develop?
- 3) What skills, competencies and/or attributes do you think have helped you navigate through the challenges in your current job role as an engineering manager?
- 4) How has your previous engineering degree and/or other degrees background help you in your current role as a manager?
- 5) As an engineer yourself, what do you think is important to managing people who come from strong technical backgrounds like yourself? What do you think is critical for engineering managers to manage people coming from strong technical backgrounds similar to yours?
- 6) Is there any further education or professional development you would like to pursue to enhance your effectiveness as a manager?
- 7) Is there anything else about your work experience that you would like to share?

Optional Questions

- 1) How do you perceive the term engineering manager?

- 2) Do you miss doing more technical work?
- 3) What is your ideal/dream job?
- 4) Have you found any informal mentors that helped you with your transition?
- 5) Did you have any role models for what a leader or a manager should like?

APPENDIX B. INITIAL RECRUITMENT EMAIL FROM HR MANAGER AT TEL CORPORATION

Subject: Request for your input on developing leadership skills

Hi xxxx,

The Talent Development team works to develop leadership skills in individual contributors (ICs). We are especially interested in people like you who have progressed from an individual contributor in a technical role to a manager role in the past 3 years.

A former intern on our team, Swetha Nittala, is a PhD student in Engineering Education at Purdue University, and is studying what factors are important for the successful transition from an IC role to a technical leadership position. Swetha will be sharing her results with Tel and will provide recommendations on how to onboard new technical leaders and how to develop individual contributors for future leadership roles. She is asking to interview 15 newly-transitioned technical managers at Tel.

I'm hoping you will be willing to spend about an hour in a skype interview with Swetha to share your valuable feedback.

I'll follow up with you to gauge your interest and if you're agreeable we can talk about scheduling a call at your convenience.

Thanks,

[HR Manager]

APPENDIX C. SECOND RECRUITMENT EMAIL FROM HR MANAGER AT TEL CORPORATION

Subject: Re: Request for your input on developing leadership skills

Cc: <researcher's email>

Hi xxxx,

Thank you for being willing to share your experiences with technical leadership development.

The next steps are to complete a demographic survey and to select an interview time using the doodle poll. Interview times are available the next three weeks. If none of these timeslots work, you can reach out to Swetha (copied on this message) and arrange for a different time.

Once you have completed the survey and chosen an interview time, Swetha will contact you with more information.

Thank you again for participating!

Thanks,

[HR Manager]

APPENDIX D. DEMOGRAPHIC SURVEY DRAFT

Title: Engineer to Manager Transition (Exported from Qualtrics Survey Tool)

Start of Block: Default Question Block

Q1 Do you have a bachelor's degree in engineering or technology?

☐ Yes

☐ No

Q2 Can you please list out the major and minor that closely represents your bachelor's degree?

☐ Major _____

☐ Minor _____

Q3 What is your highest level of degree earned?

☐ Master's degree

☐ Doctoral degree

☐ Bachelor's degree

☐ High School

☐ Associate

Q4 Can you please list out the major that closely represents your highest degree earned?

Q5 How many years of professional work experience do you have so far?

Q6 What is your current job title?

Q7 How long have you been in your current role?

☐ <6 months

☐ 6 months to 1 year

☐ 1-2 years

☐ 2-3 years

☐ > 3

Q8 How many direct reports do you have in your current role?

Q9 Did you have managerial experience in a professional setting prior to this role? If so, could you elaborate the role and responsibility?

Q10 Please read the following statements and select all that applies

- ☐ I have financial and/or budgetary responsibilities in my current role
- ☐ I have earned an MBA/Business degree prior to my transition to the current role
- ☐ I have earned an MBA/business degree after transitioning into the current role
- ☐ I perform (or have performed) performance review of one or more of my direct reports in the current role

Q11 I identify my gender as

- ☐ Male
- ☐ Female
- ☐ Prefer not to say

Q12 Please enter your full name below

End of Block: Default Question Block

APPENDIX E. CONSENT FORM

The following information sheet/consent form to be shared with the participants before the interview. I will ensure that the participant has read through the document before the start of the interview.

Introduction: I really appreciate you taking the time to talk with me! I am interested in learning about the experiences of engineers who have recently transitioned to engineering managerial roles. Mainly, I am interested in exploring how engineers characterize their transition experience, what challenges they face during the transition and how they navigate those challenges.

Interview Process: I will be asking you questions about your career experiences as related to the transition. Although, as I am interested in learning more about your experiences in your voice, I will remain fairly quiet during the interview process and let you share and talk about your experiences. Anything you share with me will be considered at face value as you are viewed as the expert of your own life and career. There will also be no right or wrong answers as I am interested in knowing your perceptions and your side of the story alone.

Confidentiality: All data will be kept confidential and stored in a secured file sharing system. The data collected will be checked and removed for any identifiers related to the individual or the organization. Only aggregate results will be published without any reference to the individual or the organization. The interviews will in no capacity be used for evaluating your or other participants' performance in the organization. The research will also be subject to IRB protocols of the University.

Risk: The risks associated with participating in this study are no more than what you would encounter in everyday life.

Voluntary nature of the participation: You could choose to not answer any question at any time during the interview if you are not comfortable. You may even choose to stop the interview at any point. You may also retract any statements made during the interview or are free to approach me later if you wish to retract any statements that you might have made during the interview.

Questions: If you have any questions or concerns about this research project, you can contact Swetha Nittala at snittala@purdue.edu. If you have concerns about the treatment of research participants, you can contact the Institutional Review Board at Purdue University, Ernest

C. Young Hall Room 1032, 155 S. Grant St., West Lafayette, IN 47907-2114, Phone (765) 494-5942, E-mail: irb@purdue.edu

APPENDIX F. COPYRIGHT

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- Jesiek, B. K., Trellinger, N., Nittala, S., & Campbell, S. J. (2017). Interns in the wild: Using structured reflection and interviews to investigate early career engineering practice. 124th *ASEE Annual Conference and Exposition*. Columbus, Ohio.

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- Williams, J., Phillips, K. W., & Hall, E. V. (2014). Double jeopardy? An empirical study with implications for the debates over implicit bias and intersectionality. *Harvard Journal of Law & Gender*, 37, 185–242. <http://doi.org/10.1016/b978-012679130-3/50035-1>.
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VITA

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EDUCATION

Doctor of Philosophy, Engineering Education, expected December 2020
Purdue University, West Lafayette, IN

- School of Engineering Education, College of Engineering
- Committee: Brent K. Jesiek (Chair), Mary Pilotte, Nathalie Duval-Couetil, Russell korte (The University of George Washington)
 - Dissertation Title: Lived experiences of recently transitioned engineering managers: An interpretive qualitative study

Master of Human Resource and Industrial Relations, May 2015
University of Illinois, Urbana-Champaign, IL

Master of Science, Physics, May 2013
Birla Institute of Science and Technology, Hyderabad, India

- Dual Degree: **Bachelor of Science**, Civil Engineering

TEACHING APPOINTMENTS

Teaching Assistant and Co-Instructor, University of Illinois, Urbana-Champaign
HRD 585: Program Evaluation, Fall 2015 (8-week course)

- Co-led weekly discussion sessions, facilitated team discussions on online platforms, reviewed and evaluated group projects

Teaching Assistant and Co-Instructor, University of Illinois, Urbana-Champaign
HRD 575: Innovations in e-learning, Fall 2015 (8-week course)

- Co-led weekly discussion sessions, facilitated team discussions on online platforms, reviewed and evaluated group projects

Graduate Teaching Assistant, University of Illinois, Urbana-Champaign CS
210: Ethics and Professional Issues in Computing, Fall 2014, Spring 2015

- Created weekly assignment and discussion content for the class; Facilitated discussions on professional development for the students; Conducted weekly office hours for providing feedback to the students

RESEARCH APPOINTMENTS

Graduate Research Assistant, Purdue University

CCE STEM: Foundations of Social and Ethical Responsibility Among Undergraduate Engineering Students: Comparing Across Time, Institutions, and Interventions, NSF 1449479, January 2018 – Present

Co-led data mixed-methods collection efforts across three universities; contributed to the development of interview protocols and surveys; coordinated and conducted over 30 interviews with undergraduate students at two universities; assisted in project management duties; mentored two undergraduate research assistants; co-led the qualitative data analysis efforts including using thematic analysis and phenomenography methods; contributed to the quantitative data analysis efforts (on-going); first-authored and co-authored multiple papers

CAREER: Becoming Boundary Spanners Investigating, Enhancing, and Assessing the Experiences of Early Career Engineers, NSF 1254323, January 2014 – 2019

Contributed to data collection efforts; analyzed more than 15 interviews of early career engineers and interns using thematic and narrative analysis approaches; mentored three graduate and undergraduate students, co-authored multiple papers.

Global Engineering Competency: Definitions, Development Paths, and Situational Assessment, NSF 1160455, January 2017- May 2017

Contributed to the development of situational judgement tests as training tools for enhancing global competency development among undergraduate engineers

Intersectionality of Non-normative Identities in the Cultures of Engineering, NSF 1428523, September 2017- December 2017

Analyzed two engineering undergraduate students' interviews using interpretive phenomenological analysis methods to identify their perceptions on diversity and identity in teams, co-authored a paper

INDUSTRY EXPERIENCE

Research Specialist: Leader and Performance Analytics, Deloitte, Houston
January 2020 – May 2020

- Proposed and conducted repeated measures survey design to investigate employee perceptions on performance evaluation rating scales, leading to an enhanced rating scale and descriptors.
- Led all data efforts to include gathering, cleaning, reviews and confirmation for a global A/B testing project with a sample size of over 10000 employees investigating

the employee perceptions on performance by ensuring conditions were isolated, user experience was accurate to design, and critical business deadlines were met

- Developed a code to automate a bi-weekly data pull task using R software to reduce task run time from 2 days to 1 hour and to ensure consistency on all accounts.
- Redesigned the annual talent survey engagement items based on feedback from upper management along and other employee data findings.
- Proposed and redesigned core performance evaluation questions for all employees by reviewing internal and external research to enhance the transparency and quality of performance measurement.
- Led a company-wide upward and peer feedback initiative by conducting several reviews with different stake-holders, incorporating different perspectives and taking data insights into account, leading to a new set of items applicable to each rater group and helping employees have more specifics and behavioral feedback on where to develop and grow.
- Refined situational judgement test items to assess leadership capabilities in managers by incorporating feedback from executives and item analysis of the pilots to ensure differentiation in scores and improve accuracy of the testing.

Talent Development Strategy Intern, [Tel Corp] May 2017 - August 2017

- Identified leadership competency gaps for engineering professionals in the IT and the network departments
- Created and delivered training content for professional development of technical program managers
- Identified leadership needs for store managers across Sprint using innovative job analysis techniques and created leadership training content
- Developed an informal mentoring framework for employees across Sprint in collaboration with the talent development team

Research Consultant/ Process Analyst, RISE Corporation, Texas

February 2016 - July 2016

- Conducted market research by analyzing over 100 apps and relevant research papers for an educational application (App) designed to enhance student performance
- Translated research findings on performance management for students and parents into deliverable product requirements
- Analyzed performance and procrastination trends among professionals and k-12 students to provide relevant feedback and training provisions for potential users of the App

Risk Analyst, Credit Suisse, India

July 2012 - December 2013

- Liaised with several departments across the global business unit for analysis and query resolution to close around 15 pending breaks in the project using Informatica and Microsoft Access tools
- Mentored and coached 5 new hires and intern

AWARDS, GRANTS and CERTIFICATES

Conference Travel Grant for Purdue Engineering PhD Candidates, College of Engineering, August 2019

Ripples of Hope Service and Leadership Certificate, School of Engineering Education, December 2018

Explorers Fellowship, School of Engineering Education, August 2016 – July 2016

JOURNAL PUBLICATIONS

Jesiek, B. K., Trellinger, N., & **Nittala, S.** (*revise and submit*) Learning the Plays and Signals: Narratives of Early Career Engineers as Boundary Spanners. *Journal of Engineering Studies*.

Nittala, S. (*in preparation*). Navigating the differences between academic and industry research settings: An Autoethnography. To be submitted to *Journal of Research Practice*

Nittala, S., Claussen, S.A., Zoltowski, C.B., Jesiek, B.K. (*in preparation*). Students' ways of experiencing ethical situations. To be submitted to *Journal of Engineering Education*

PEER-REVIEWED CONFERENCE PAPERS (in reverse-chronological order)

Zoltowski, C. B., & Jesiek, B. K., & Claussen, S., & Howland, S. J., & Kim, D., & **Nittala, S.** (2020). Foundations of Social and Ethical Responsibility Among Undergraduate Engineering Students: Overview of Results. In *2020 ASEE Virtual Annual Conference Content Access*, June 21-24, Virtual Online. 10.18260/1-2--34688

Nittala, S., & Jesiek, B. K. (2019). Engineer to Manager Work-Role Transition: A Single Case Narrative. In *2019 Annual European Society for Engineering Education (SEFI) Conference*, September 16-19, Budapest, Hungary

Nittala, S., & Jesiek, B. K. (2019). Changes in perceptions of ethical climate among undergraduate engineering students. In *2019 Annual European Society for Engineering Education (SEFI) Conference*, September 16-19, Budapest, Hungary

Nittala, S., Mitchell, D., & Howes, S. (2019) Survey data as a novel approach to job analysis. In *2019 Annual SIOP Conference*. April 4-6, National Harbor, MD

Nittala, S., & Jesiek, B. K. (2018). Work Experiences of Engineering Managers: Challenges, Strategies, Competencies. In *2018 FIE Frontiers in Education Conference*, October 3-6, San Jose, CA

Nittala, S., & Jesiek, B. K. (2018). Managing Engineering Talent in Organizations: A Qualitative Systematic Literature Review on Engineering Talent Management. In *2018 ASEE Annual Conference & Exposition*. June 24-27, Salt Lake City, UT

Nittala, S., & Zephirin, T., & Howland, S. M. J., & Kim, D., & Katz, A., & Jesiek, B. K. (2018), Investigating Influences on First-year Engineering Students' Views of Ethics and Social Responsibility. In *2018 ASEE Annual Conference & Exposition*, June 24-27, Salt Lake City, UT

Jesiek, B. K., Trellinger, N., & **Nittala, S.** (2017). Closing the practice gap: Studying boundary spanning in engineering practice to inform educational practice. In *2017 IEEE Frontiers in Education Conference*, October 18-21, Indianapolis, IN

Jesiek, B.K, Trellinger, N., **Nittala, S.**, & Campbell, S.J., (2017). Interns in the Wild: Using Structured Reflection and Interviews to Investigate Early Career Engineering Practice. In *2017 ASEE Annual Conference & Exposition*. June 25-28, Columbus, OH

Kirn, A., Godwin, A., Pearson, N., Rodriguez-Simmonds, H.E., Rohde, J.A., Verdín, D., Ross, M.S., Vealey, K.P., Jackson, B.P., **Nittala, S.** and Li, T., (2017). Board# 75: Building Supports for Diversity through Engineering Teams. In *2017 ASEE Annual Conference & Exposition*. June 25-28, Columbus, OH

WORKSHOPS, PANELS, SYMPOSIUMS

Co-facilitator, Spanning Cultural Boundaries Workshop, June 17th, 2018, DePuy, Indiana

Invited attendee, Research in Engineering Practice (REP) Workshop, October 2-3, 2018, San Jose, CA

Panel Speaker, Innovative Approaches to Job Analysis: A Practioners-Focused Symposium, 2019 Annual SIOP Conference. April 4-6, National Harbor, MD

Co-organizer and Facilitator, Industry Panel Discussions, ASEE Illinois-Indiana Section Conference, April 7th, Purdue University, IN

Trellinger, N. M., Jesiek, B. K., & **Nittala, S.** (2017). Workshop: A narrative approach to broadening schema about engineering professors. In *2017 IEEE Frontiers in Education Conference (FIE)*, October 18-21, Indianapolis, IN

LEADERSHIP AND SERVICE ACTIVITIES

Co-organizer, 2018 ASEE Indiana-Illinois Regional Conference, Purdue University, Indiana

- Co-led a team of 10 graduate and 4 undergraduate students to organize the annual conference (150+ attendees)

Core-Committee member, Entrepreneurs in I/O psychology, SIOP, 2018-2019

Core-Committee member, Women in I/O psychology, SIOP, 2018- 2019