

## **Literature Review of Counterfactual Thinking and Career Motivation Theory for Early Career Women Engineers**

### **Ms. Renee Desing, Ohio State University**

Renee Desing is currently a graduate student at the Ohio State University in the Department of Engineering Education. Ms. Desing holds a B.S. in Industrial Engineering from the Georgia Institute of Technology and a M.S. in Industrial Engineering and Operations Research from the Pennsylvania State University. Most recently, Ms. Desing worked as a managing consultant for IBM Public Sector Advanced Analytics.

### **Dr. Rachel Louis Kajfez, Ohio State University**

Dr. Rachel Louis Kajfez is an Assistant Professor in the Department of Engineering Education at The Ohio State University. She earned her B.S. and M.S. degrees in Civil Engineering from Ohio State and earned her Ph.D. in Engineering Education from Virginia Tech. Her research interests focus on the intersection between motivation and identity of undergraduate and graduate students, first-year engineering programs, mixed methods research, and innovative approaches to teaching.

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## **Abstract**

Navigating the workplace as an early career professional is daunting for anyone, especially women entering a technical field such as engineering. When encountering challenging, gender-based situations, women react in various ways, from ignoring the situation to leaving the engineering field completely. Through a literature review, this paper investigates conceptually aligning counterfactual thinking and career motivation theory for early career women engineers. Counterfactual thinking is the creation of alternative scenarios to events that already occurred and imagining different consequences or benefits. Career motivation theory aims to understand career plans and decisions. From these theories, this review explores the effects of counterfactual thinking on women engineers' reactions to challenging situations, from work-life balance to discrimination, that they encounter in the workplace during their early careers and how that affects their long-term career motivation. The results of this review provide an initial conceptual alignment for integrating counterfactual thinking and career motivation theory and will lead to future research to understand how early career women engineers process the situations they are experiencing, how they use counterfactual thinking during these situations, and the impact on their career motivation.

## **Introduction**

It is essential to understand why women choose to stay in or leave engineering professions and what organizations can do to support their persistence in engineering careers. The percentage of engineering bachelor's degrees earned by women in the U.S. has remained between 18.1% and 20.5% from 2000 to 2015, with women receiving 20.1% of degrees in 2015 [1]. By contrast, women's representation in the engineering workforce has been steadily increasing since the 1990's, from 8.6% in 1993 to 14.5% in 2015 [1]. However, according to statistics from 2010, within five years of graduation, 36 percent of women who obtained engineering bachelor's degrees either left or never entered the field and within fifteen years after graduation, 60 percent of women who earned engineering bachelor's degrees had left the field [2]. Despite the recent increases, these numbers indicate that women are still underrepresented in the workforce and that retention of women engineers in their early career remains an issue.

Various factors have been identified as the reasons women leave engineering careers. In a 2012 report, a survey of over 5,500 women engineering alumnae found that those who left engineering were less likely to report opportunities for training and development that would have helped them advance, less likely to report support from a supervisor or co-worker, more likely to report undermining behaviors from supervisors, and less likely to report support for balancing work and non-work roles than those that remained in the field [3]. Fouad summarized these results when speaking with the American Association of University Women (AAUW) as follows:

A lot of the studies have focused on fixing women—fixing their confidence, fixing their interests. We did not find that any of those factors influenced women engineers' persistence decisions at all, which is why we are saying we really need to be focusing on the environment. [4, p. 93]

Other identified factors that are a result of the company or organization environment include women experiencing discrimination and/or harassment and the failure of the organization to respond [5], [6], company barriers such as a frustrating work environment and problems with onboarding [4], [5], [7], and gender bias and stereotype threat [4]–[6]. However, there are also factors for leaving engineering careers that relate to the individual women. These include identities inconsistent with engineering and no strong commitment to the field of engineering [5], [6], feeling the need to prove themselves and blaming themselves for negative career experiences [6], and having to make work-life compromises [6], [8].

These challenges that women engineers experience in the workplace affect their motivation to persist in their careers [5]. When women remain in their engineering careers, they enhance not only diversity of the workplace but also the future of the engineering workforce. For example, Fouad et al. [3] argue that the loss of women engineers is a loss to organizations, education systems, society, the U.S.'s competitive edge, and to the women. Chubin, May, and Babco agree that a lack of diversity “underpins the future engineering workforce” [9, p. 74]. Therefore, women need support and strategies for overcoming these challenges and remaining motivated to continue in their careers.

### *Purpose*

The purpose of this literature review is to examine the current research on counterfactual thinking and career motivation theory, align these concepts, and apply them to women engineering professionals in their early career, particularly those that are experiencing gender-based challenges in the workplace. The researchers explore how counterfactual thinking may be used to mitigate these situations and help women remain motivated and persist with their engineering careers. This understanding will start to build the foundation of factors and variables that affect career motivation for early career women engineers and how retention in the workplace can be improved through counterfactual thinking as a strategy.

### *Scope*

The scope of this literature review includes women in engineering careers, especially those within the first 10 years of their career. The literature includes historical contexts as well as recent research as it relates to career motivation theory, counterfactual thinking, and women's experiences and challenges in an engineering workplace. The following definition of gender-based challenges will be used throughout this paper: The U.S. Equal Employment Opportunity Commission defines sex-based discrimination as “treating someone (an applicant or employee) unfavorably because of that person's sex” and sex discrimination harassment as including “unwelcome sexual advances, requests for sexual favors, and other verbal or physical harassment of a sexual nature. Harassment does not have to be of a sexual nature, however, and can include

offensive remarks about a person's sex" [10]. In addition to sexual discrimination and harassment, other gender-based challenges include work-life balance, especially for those with families and children; unequal pay; less access to professional development opportunities, such as networking and training; and lack of support from managers and co-workers [5]–[7].

### *Research Question*

This literature review aligns career motivation theory with the use of counterfactual thinking by early career women engineers to overcome gender-based challenges. It establishes a foundation to address the following research question: *How does early career women engineers' use of counterfactual thinking, when experiencing gender-based challenges, impact their career motivation?*

### **Methods**

This literature review follows the basic engineering education literature review guidelines defined by Borrego, Foster, and Froyd [11], including identifying the purpose and scope, described above, as well as the search of databases, journals, and key terms, and analyzing the results. The databases utilized for the search for articles included Academic Search Complete and EBSCO. The following journals and sources resulted from the search: *Journal of Engineering Education*, *Journal of Women and Minorities in Science and Engineering*, *Journal of Vocational Behavior*, *Personality and Social Psychology Bulletin*, *Journal of Experimental Social Psychology*, *American Society for Engineering Education* conference proceedings, and reports by the National Science Foundation and the American Association of University Women (AAUW). Key search terms used included a combination of women in engineering, career motivation, and counterfactual thinking in conjunction with early career professional, recent graduates, career transition, workplace culture, workplace challenges, persistence, and retention. Through the search, articles regarding career motivation and counterfactual thinking for women, engineers, and workplace culture are included in this review. The results are synthesized and discussed in the following sections.

### **Results**

The results of the literature search included a variety of articles, reports, and conference proceedings for both career motivation and counterfactual thinking. First, an overview of Counterfactual Thinking and Career Motivation Theory is provided. Next, the literature review provides applications of these theories for women engineers in the workforce, their experience with negative events and barriers, and the consideration of their future motivation.

#### *Counterfactual Thinking Overview*

Counterfactual, by definition, is "contrary to fact" [12]. Counterfactual thinking is defined as thoughts about what might have been or alternatives to reality [13] and is comprised of two components: an activation, often triggered by a negative emotional experience, and its content, the makeup of the counterfactual thought [14]. Counterfactual thoughts are also categorized by their direction, that is, whether their imagined realities are better (upward) or worse (downward)

than their actual reality [15]. The structure of counterfactual thoughts may also be additive, adding new elements to reality, which is more likely after events of failure, or subtractive, removing elements from reality, which is more likely after events of success [16].

Furthermore, additional theories are used to describe counterfactual thinking rationale and function. Norm Theory explains that counterfactuals are more likely to be generated for exceptional events rather than normal ones, an affective response to an event is enhanced if the cause is abnormal, and counterfactual generation depends on the ease with which an alternative is generated and how close the alternative or change is to reality [17]. Functional Theory explains that counterfactual thinking is both an affective and preparative function, that counterfactual thoughts may influence behavior and performance improvement, and that the direction of the counterfactual thought impacts both affect and behavior, such that downward counterfactuals cause more positive affect while upward and additive counterfactuals increase intentions to improve future performance [18], [19].

### *Career Motivation Theory Overview*

Career motivation theory is defined as the motivation associated with career decisions and behaviors, including job searching and goal setting, as well as their interactive relationship with individual characteristics and situational conditions [20]. The individual characteristics of career motivation theory are identified as (1) career identity, which is the relationship between one's career and identity, including the desire for upward mobility; (2) career insight, which is the perceptions of oneself and the organization, and how these perceptions are related to career goals; and (3) career resilience, which is the resistance to career disruptions in less than optimal work environment conditions, including self-efficacy, risk taking, and dependency [20]. The situational conditions include support for career development, opportunities and rewards, structure for goal setting, organizational flexibility, competitive situations, and group cohesiveness, to name a few [20]. Career decisions and behaviors include career identification, work involvement, desire for upward mobility, career planning and establishing career goals, responsiveness to social conditions, risk taking, and relying on others [20].

To understand the relationship between these three individual domains, and the situational and behavioral components, London [20] defines his career motivation model with two processes: (1) prospective rationality, where career decisions and behaviors are based on desired outcomes, and (2) retrospective rationality, where career decisions, behaviors, and situational conditions affect one's psychological state, essentially evaluating the consequences of one's actions and decisions. In an effort to expand the three domains, Noe, Noe, and Bachhuber [21] tested specific individual and situational factors that impact career motivation, concluding that work role salience, an individual characteristic defined as the perceived importance of work, and job characteristics, a situational factor, are the strongest correlates to career motivation. Building on career motivation theory, Locke and Latham [22] evaluated goal-setting theory and how goal commitment, goal importance, self-efficacy, task complexity, and feedback impact choice, persistence, and performance. The authors conclude that goal-setting theory "focuses primarily on motivation in work settings" [22, p. 714].

### *Counterfactual Thinking and Career Motivation in Women and Women Engineers*

The study of gender differences in career motivation, choice, achievement, and behavior has changed over time as the role of women in society has changed. Zytowski [23] differentiated between the work life of women and men by focusing on women's role as a homemaker, while also indicating that women's vocation is determined by both internally motivating preferences and external, situational, and environmental factors. As women's role in the workplace evolved, Farmer [24] identified a set of personal and environmental factors that affect women's career motivation and achievement and proposed her own model of career and achievement motivation based on a person's background, personal, and environment factors to explain gender differences [25], [26]. More recently, Stitt-Gohdes [27] evaluated women's career development and concluded that while there are individual factors, the external and societal factors, such as sex discrimination and stereotyping of occupations, are more significant. However, Domenico and Jones [28] concluded that while women's career aspirations have evolved over the twentieth century, women are still working in traditionally female-oriented jobs and are affected by factors such as gender, socioeconomic status, and parental expectations.

Subsequent research has further studied how career motivation in engineering, specifically, differs by gender. Schaefer, Epperson, and Nauta [29] studied the effects of ability, self-efficacy, expectancy-valence, interest congruence, barriers, and supports on the gender differences in persistence in engineering majors. The authors found that persistence rates were not significantly different between genders and that ability, measured by GPA and ACT scores, was the key contributor to persistence. Dasgupta, McManus Scircle, and Hunsinger [30] also studied gender differences in career motivation in engineering students by investigating the impact of the proportion of women to men in small group settings on women's motivation, finding that group compositions of equal or majority female students had a more significant, positive influence on women's motivation than those in groups of majority male students. Rosenbloom, Ash, Dupont and Coder [31] studied gender differences in information technology career choices, finding that the lack of women in technology is due to men and women valuing different aspects of work and therefore making different career choices.

There is limited research on gender differences in counterfactual thinking. However, one study provided examples that the content of counterfactual thoughts in educated midlife women consisted of missed opportunities in work and education, particularly due to their role as homemakers, their current emotional distress, and how to make improvements for the future [32], which is consistent with upward counterfactual thinking. Therefore, the gender differences of career motivation in women, specifically women engineers, is important to consider when performing future research on the impacts of counterfactual thinking.

### *Counterfactual Thinking and Career Motivation in the Workplace*

The use of counterfactuals in the workplace has been studied for entrepreneurs and negotiators, albeit with varying results. It was initially found that entrepreneurs generate less counterfactual thoughts than non-entrepreneurs [33]. Later research disagrees. For example, when studying how entrepreneurs think, reason, and develop innovative opportunities, counterfactual thinking is

suggested as a mechanism for opportunity identification by proposing that entrepreneurs are more likely to generate upward and additive counterfactuals [34]. However, further research will be needed to validate these propositions. While studying the relationship and conditions between entrepreneurial self-efficacy and counterfactual thinking, the findings show that the more positive affect of the counterfactual, the more entrepreneurial self-efficacy increases while engaging in counterfactual thinking, but an entrepreneur's disposition may be a mediating effect [35]. In the case of negotiators, it was found that additive counterfactual thoughts regarding past negotiations increased the performance of negotiators in future negotiations, demonstrating how they learned from past experiences [36].

In an editorial in the *Journal of Vocational Behavior*, Tinsley [37] remarked that there is a lack of, and therefore a need for, studying early career professionals and their transition from school to the workplace. Feij, Whitely, Peiró and Taris [38] addressed this call to action in the same issue through a longitudinal model of the development of career-enhancing strategies, finding that the relation between these strategies and intrinsic values and the importance of work increased over time while relations between supervisors and co-workers decreased. In a different study of proactive career behavior across Europe, Claes and Ruiz-Quintanilla [39] analyzed various factors of the early career experience, finding that culture is a significant factor and that the femininity dimension, which includes a good working relationship with direct supervisors and coworkers, employment security, and the quality of working life, facilitates behaviors in skill development and networking which the masculinity dimension, defined as earnings, recognition, opportunity for advancement, and competition among colleagues, inhibits.

Counterfactual thinking and career motivation in the engineering workplace will require additional research. However, it is positive that the current literature is pointing to the importance and need for understanding the impact of counterfactuals on early career professionals.

#### *Counterfactual Thinking and Career Motivation in Negative Events*

Counterfactual thinking has been studied in events that elicit negative emotions, such as cases of depression or traumatic life events. When assessing the generation of counterfactuals in various cases of negative emotions or depression, upward counterfactuals are the most commonly generated for these experiences [40]–[42]. Additionally, when studying counterfactuals generated by victims of traumatic life events as a means for coping, victims' counterfactuals focused on their own behaviors to improve the event outcome, rather than the behavior of others involved in the event [43], [44]. However, research differs on whether those that are generating more counterfactuals are experiencing more distress. Davis et al. [43] found a relationship between the two while Dalgleish [44] explicitly stated they did not find evidence of a relationship. Additional support for this relationship, though, was found in the specific case of rape victims, where it was seen that as they generated upward counterfactuals, their well-being decreased and their self-blame increased [45]. Therefore, when experiencing negative emotions, such as those during traumatic events, the victim is more likely to generate upward

counterfactuals to cope with the situation, but it may increase their distress and decrease their overall well-being.

When considering the impact of negative events in the workplace, a variety of research has studied how the workplace environment and the support it offers to employees affects their career motivation. Stumpf, Brief, and Hartman [46] studied how people become motivated to cope with career-related stressful events, finding that as individuals use energy to deal with their emotions during these stressful events, they feel greater anxiety and less positive about their performance. Swanson and Woitke [47] surveyed the career barriers women experience in the workplace, such as lack of confidence, discrimination, decision-making difficulties, dissatisfaction with career, and conflict between children and career demands, and how career counseling interventions may be used to address these barriers. London [48] built on his own career motivation theory to examine the relationship between empowerment, support for career development in the workplace, and career motivation, finding that employees who self-rated themselves as being empowered and receiving support for career development were also seen by their supervisors as having high career motivation.

Therefore, upward counterfactuals, where the imagined thoughts are better than reality, are generated after experiencing negative emotions in order to cope with the event. The work environment and support professionals receive from their organizations, whether positive or negative, affects women's career motivation, empowerment, and persistence as well as the type of counterfactual thought generated during negative situations.

#### *Counterfactual Thinking, Event Controllability, and Future Career Motivation and Behavior*

When generating counterfactuals, there is an "illusion of control" [49] regarding the past event as well as future performance. For example, the extent of the perceived control of a situation impacts the counterfactuals that are generated [50], [51], such that upward counterfactuals are more frequently generated after controllable outcomes and downward counterfactuals are more frequently generated after uncontrollable outcomes, which is consistent with the functional theory of counterfactual thinking [52]. Furthermore, the generation of upward counterfactuals correlates to higher perceptions of control and changes in performance during future events [53]. Roese, Smallman, and Epstude [54] more recently introduced self-initiation into the controllability of counterfactuals and their impact on future improvement, finding that when episodes are self-initiated, the counterfactuals focus internally on the self and what could have been done differently to improve performance.

Counterfactuals may additionally control future performance through either behavioral intentions or mindsets and motivation, as supported by the functional theory of counterfactual thinking. When studying the relationship between counterfactual thinking and motivation, the direction of the counterfactual, whether upward or downward, depends on the type of motivational goal, level of preparation, and type of outcome or mood, whether positive or negative [55]. For example, greater motivation and performance improvement occurs after the generation of upward counterfactuals for those that believe goals and improvements are attainable [56]. Additionally,



when downward counterfactuals generate a negative outcome, motivation and improvement are increased [57]. Furthermore, Converse et al. [58] studied the effects of a proactive personality on career motivation, where proactivity is a dispositional characteristic, and self-control, where an individual makes an effort to modify their own thoughts, feelings, or behaviors. The authors concluded that proactive personality is a predictor of extrinsic career success and self-control is a predictor of both extrinsic and intrinsic career success, demonstrating the impact of one's personality on career behavior. Therefore, counterfactual thinking affects future career performance and motivation based on the direction of the counterfactual and the controllability of the event outcome.

## **Discussion**

Based on the literature review results, counterfactual thinking and career motivation theory are well-aligned to address the gender-based challenges that early career women engineers experience in the workforce. First, career motivation theory and counterfactual thinking are aligned through their definitions. London [20] defines one of the career motivation model processes as “retrospective,” to relate the individual characteristics, situational characteristics, and career decisions and behaviors to evaluate the consequences of these decisions. Similarly, counterfactual thinking is a retrospective process, by evaluating events that have already occurred and imagining alternatives that are better or worse than reality [13]–[16]. Furthermore, London's [20] integrated model demonstrates that the situational characteristics only interact with individual characteristics retrospectively, which aligns with outcome controllability in counterfactual thinking [50]–[53]. Additionally, the preparative function of counterfactual thinking has been found to be goal-oriented and impacts goal-directed behavior [18], which relates to the goal-setting decisions and behaviors of career motivation theory and its interaction with the individual career insight domain [20], [22]. This alignment will determine the consequences or outcomes of events, the direction of the counterfactual, and the impact these situations have on future performance, such as career goal-setting.

Next, when applying this alignment of career motivation and counterfactual thinking for women in the workplace, women experience negative emotions when encountering situations of gender-based discrimination in the workplace [59]. If women are experiencing situations of negative emotions, then they are more likely to generate upward counterfactual thoughts [40]–[42]. Furthermore, upward counterfactuals are more frequently generated after controllable events and are correlated with higher perception of control and improved performance of future events [53], [54]. However, situations of gender-based discrimination may be considered uncontrollable events for women in the workplace. In this case, downward counterfactuals are more likely [52], which may increase their overall well-being [45] as well as their motivation with respect to future improvement [57]. Additional research will be needed to determine the direction of counterfactual thought that women generate in gender-based discrimination situations and their perceived control of the situations and future events.

Finally, counterfactual thinking influences motivation and behavior intentions [55]–[57], [60]. This is aligned with career motivation theory's career decisions and behaviors and its integration

with individual and situational characteristics [20]. This overarching alignment between counterfactual thinking and career motivation theory may be used to understand the decisions of women engineers in their careers and their future motivation and performance in the workplace.

### **Limitations**

First, the search terms used may not have found all relevant literature for this literature review. Of the literature found, it is noted that there is limited research on gender differences in counterfactual thinking as well as in workplace settings beyond entrepreneurship. Additionally, there is limited research on the career motivation of early career professionals, despite a recognized need to study the transition from college to the workplace and to counteract the data indicating a decrease in women engineering professionals after the first ten years. These limitations may be addressed through future research.

### **Conclusion and Future Research**

Career motivation theory and counterfactual thinking are conceptually aligned through their functional definitions, including their retrospective process and goal-setting orientation and the impact the direction of the counterfactual thoughts has on motivation and future performance, even in cases of negative or traumatic events. This alignment is well-suited to studying women engineers in the workplace, their experiences with gender-based discrimination, and subsequent strategies to remain motivated in their careers.

Future research to test this conceptual alignment will be performed utilizing a mixed methods research design to study the potential impacts counterfactual thinking has on women engineers' career motivation, including whether they persist in their career and how counterfactual thinking may be used to influence their motivation when experiencing negative events, such as gender-based discrimination. Over 12-18 months, the study will be implemented to analyze whether and how women use counterfactual thinking as a strategy in gender-based situations, the direction of the counterfactual used, and whether women experience perceived control over past events and therefore preparedness to address future situations. Existing literature and protocols will be considered, such as the Counterfactual Thinking for Negative Events Scale [61] and the Career Barriers Inventory [62], [63], which are appropriate for studying the effects of gender-based discrimination in the workplace. Through a sorting process and interview, women will identify the importance of negative workplace situations on the career decisions they have made and how counterfactual thinking may be used to mitigate those situations. Ultimately, the study will result in a set of viewpoints that explain the experiences that early career women engineers face in the workplace, the relationship between counterfactual thinking and career motivation, and the impact that this relationship and the women's experiences have on career decisions.

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