

## Impact of Women Empowerment on Career Advancement of Female Engineers

Elizabeth Nabwire Ekakoro<sup>1</sup>

<sup>1</sup>ekakoroliz@gmail.com

<sup>1</sup>PhD Student, Masinde Muliro University of Science and Technology, P. O Box 190-50100, Kakamega-Kenya

---

### ABSTRACT

*The importance of women in national development cannot be understated, and women's empowerment is still a topic of discussion on a global scale. The attainment of gender parity and the empowerment of women have been considered essential to the accomplishment of sustainable development objectives. As a result, the participation of women is becoming more prevalent in a variety of areas, including engineering. In addition to providing excellent service, women in this field have debunked the myth that engineering is a male-dominated profession. Organizations that employ female engineers report high levels of satisfaction with the outcomes attained, and this inspires more women to join the field. Even though more women are graduating from engineering programs, very few of them remain in the workforce, and of those who do, very few move up the corporate ladder. This raises the question of whether empowerment alone will be sufficient to keep female engineers on track and guarantee their career advancement. In light of the aforementioned, this study examined the impact of women's empowerment on the career advancement of female engineers. The study employed a descriptive survey research design to investigate how female engineers' career advancement is influenced by promotion, inclusion, continuous professional development, and recognition. 30 respondents made up the target population of female engineers across all cadres. Data was gathered online using a self-administered questionnaire with the help of Google Forms. The questionnaire items were highly appropriate for data collection, as evidenced by the Cronbach's alpha value of 0.97. The relationship between the independent and dependent variables was investigated using inferential statistics. All of the independent variables (promotion,  $r=0.922$ ,  $p<0.01$ ), continuous professional development,  $r=.935$ ,  $p<0.05$ , recognition,  $r=0.897$ ,  $p<0.01$ , inclusion, and  $r=.939$ ,  $p<0.05$ ) showed a strong positive correlation with the dependent variable, career advancement of female engineers. The study's findings indicated that female engineers' career advancement was significantly impacted by inclusion. The findings also revealed that continuous professional development was essential to the advancement of female engineers in their careers. The study recommended inclusion of female engineers in technical matters, equal pay for equal work, continuous training, and mentorship to ensure career advancement and to keep more female engineers on board.*

**Keywords:** Career Advancement, Female Engineers, Inclusion, Training, Women Empowerment

---

### I. INTRODUCTION

The empowerment of women is essential to achieving the Sustainable Development Goals (SDGs) of the United Nations, especially the fifth Sustainable Development Goal that promotes the equality and empowerment of women and girls (UN Women, 2022). This has encouraged women to pursue careers in a variety of fields, and the perception that engineering is a male-dominated field is gradually fading away as more women pursue careers in science, technology, engineering, and math (STEM) (Dutta, 2015). If the SDGs are to accomplish this cross-cutting agenda, then an institutional approach to gender equality and women's empowerment is imperative (Odera & Mulusa, 2020). Though notable progress has been made, Alfred and Rice (2014) report that women are still underrepresented in STEM areas, especially engineering. In comparison to their male counterparts, women still make up a small portion of the academic and professional communities (Nina, 2022). Therefore, in terms of having more female engineers on board, the topic of empowerment cannot be disregarded.

Concern over the representation of women in engineering is widespread. The engineering workforce in the United States comprises only 11% of women, whereas statistics indicate that over 25% of women are engineering graduates (Fouad et al., 2011). Only 9% of the United Kingdom's engineering workforce is female, and the shortage is considered an imminent threat to businesses in the UK (Maskey, 2018). While the number of women graduating from engineering schools in Thailand is increasing, unlike their male counterparts, licensed female engineers are unlikely to receive promotions (Kaewsri & Tongthong, 2013). It is further reported that in Thailand, promotions are granted to 3.3% of male engineers and only 0.3% of female engineers.

One of the primary objectives of the African Union's African Women's Decade is women's empowerment and gender equality. Equal opportunities for women in all fields, including promotion and parity at work, is one of the themes (African Union, 2013). Even though there has been some progress toward achieving gender equality and women's empowerment during the 2010–2020 declared decade, there is still work to be done. The empowerment goal of the SDGs is undermined by the persistent gender gap in Sub-Saharan Africa (Ogechi, 2020). Less than 10% of engineers in Kenya are women, and only 361 out of 2085 women registered in various engineering categories are professional engineers (17%), according to the Engineering Council of South Africa. Many female engineers, according to Nina (2022), eventually leave the field to pursue careers in more gender-neutral or female-dominated fields. Although there is a legal framework for gender equality in Kenya's 2010 constitution, its effectiveness in being enforced is up for debate. Even though research suggests that bias and work-life balance are the main reasons women leave engineering (Bryce & Far, 2019), the gender rule would still be difficult to apply in Kenya's construction industry because there are so few female engineers. Workplace culture, promotion, pay, and mentorship have been reported to be key influences on whether women stay or leave the engineering profession (Fouad & Singh, 2011). This study aimed to investigate how women's empowerment affects the career advancement of female engineers, with the goal of understanding why and how to bring more women on board.

## 1.2 Research Objective

The objective of this study was to examine the impact of women empowerment on the career advancement of female engineers.

## II. LITERATURE REVIEW

### 2.1 Theoretical Review

Maslow's Hierarchy of Needs (1943) and Herzberg's Two-Factor Theory of Motivation (1959) served as the study's guiding theories. Maslow's theory is anchored on the grounds that humans are born with certain basic needs that must be satisfied before they can desire any secondary needs (Rahimi et al., 2016). Only when the basic needs of safety, security, and belonging are met can an individual achieve self-actualization, or growth (Coatesworth, 2015). In order for female engineers to feel satisfied in their jobs, they need to have a sense of belonging through inclusion in all the technical activities in their field. Herzberg's two-factor theory, which is motivated by Maslow's theory, asserts that certain job-related elements lead to job satisfaction while other job-related factors shield against satisfaction (Alshmemri et al., 2017). According to Herzberg, factors related to a lack of hygiene cause job dissatisfaction, whereas motivators guarantee job satisfaction. Salary, job security, working conditions, status, interpersonal relationships, and policies are considered hygiene factors, whereas achievement, recognition, growth, and opportunities for promotion and responsibility are considered motivating factors (Jones & Lloyd, 2005).

To improve their performance and self-esteem, female engineers seek recognition and acknowledgement for their achievements. Coatesworth (2015) highlights that with positive feedback; employees are inspired to work harder. Female engineers are driven by promotion as well as the desire for equal pay for equal work, just like their male counterparts. If growth opportunities for ongoing training are available, female engineers will perform better and have higher levels of job satisfaction. This will help them stay in the workforce as their careers progress. Job satisfaction can arise from the presence of motivational factors, but it cannot occur in their absence (Alshmemri et al., 2017).

### 2.2 Empirical Review

Women's empowerment has been explained as a way to enhance women's capacity to direct their own lives by identifying, confronting, and overcoming obstacles in their path (Dandona, 2015). Subsequently, women's empowerment enables women to obtain well-paying employment or be better equipped to effect changes that would improve society (Sridevi, 2016). The idea that engineering is only a male domain has already been debunked by women who opt to work in these fields, a positive step towards the realization of sustainable development goals on gender parity and women's empowerment. There is, however, cause for concern regarding these women's career advancement. Yates and Skinner (2021) conducted an analysis of how career advancement in engineering was conceptualized by female engineers. The study investigated the perceptions of career advancement barriers held by female engineers as well as their experiences navigating their careers. In-depth interviews with female engineers in the UK were undertaken, and template analysis was used for analysis. Three structural barriers were identified by the researchers as impeding women's career advancement in engineering, according to the participants; promotions were most likely granted to those who ascribed to the ideal worker ideology, high-status individuals, or well-known people,

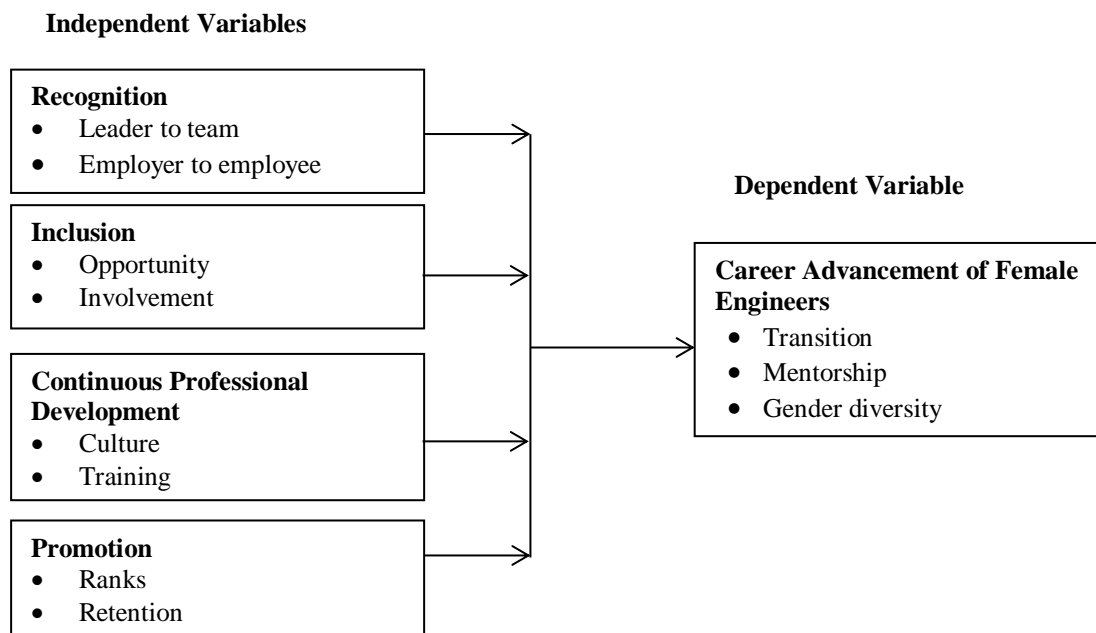
who were mostly men. The findings also demonstrated that female engineers found it more challenging to acquire the professional skills necessary for success in the workplace and to persuade upper management of their ability and drive. Dissatisfaction with their professional growth was found to be a contributing factor in women leaving engineering jobs (Yates & Skinner, 2021).

Examining how institutional policies could improve female engineers' self-perceptions and motivations in order to support their retention, Shull and Weiner (2002) launched a program to apply teaching strategies meant to foster the following educational attributes: increased motivation, effort, and persistence. This was done by utilizing the self-efficacy theory. The specific approach was selected in order to create and instruct a course aimed at educating women engineers in the field of diagnosing and repairing computer issues. The women's proficiency in computer technology was consistently demonstrated and reinforced throughout the course, setting them apart from their peers and creating an environment that boosted the women's sense of self-efficacy and related control beliefs. This training method was recommended to support important engineering transition points, as it has been shown to be successful in removing obstacles that prevent women from participating fully in the engineering workforce.

In Bosnia and Herzegovina, a study was conducted on the motivation of female engineers working in the construction industry (Hodzic et al., 2022). The study sought to understand female engineers' status and motivation in the construction sector. All aspects of female engineers' motivation were impacted by their professional experience. External regulations were also found to motivate female engineers. Bornsen (2012) conducted a study to examine the perspectives of female engineers on their training, jobs, and what drove them to stay in the industry. A qualitative research design was employed to assess the motivation and adaptability factors that women use to support their decision to major in engineering and continue in the engineering field. The study identified four categories: motivation, learning environment, adaptability, and field attraction, as reasons why women stay in engineering.

### 2.3 Conceptual Framework

Below is an illustration of the interrelationship between identified women empowerment indicators (recognition, inclusion, continuous professional development, and promotion) and career advancement of female engineers.



**Figure 1**  
*Conceptual Framework*

### III. METHODOLOGY

In this study, a descriptive survey research design was used. Thirty female engineers from all cadres were the target population. An online questionnaire was employed. The sample size was calculated using Yamane's formula, at 95% confidence level and a 5% margin of error:-

$$n = \frac{N}{1+N(e^2)}$$



Where;

**n** = Sample size, **N** = Population under study, **e** = 5% error, **1** = Constant

The sample size was calculated as;

$$n = \frac{30}{1 + 30(0.05^2)}$$

**n=27.91 ~ 28**

The study adopted a 5-point Likert scale type of questionnaire as pursues: - 1- Strongly disagree, 2- Disagree, 3-Neutral, 4-Agree, 5- Strongly agree. The collected data was analyzed using statistical package for social sciences software (SPSS). A frequency distribution table was used for tabulating the calculated statistic for each variable. The researcher employed regression and correlation analysis to evaluate the importance of the chosen model and variables. The regression equation was adopted as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$$

Where:

Y = Career advancement of female engineers;  $\beta_0$  = Constant term;  $\beta_1, \beta_2, \beta_3$  and  $\beta_4$ , = Beta coefficients;

$X_1$  = Recognition;  $X_2$  = Inclusion;  $X_3$  = Continuous professional development;  $X_4$  = Promotion

$\varepsilon$  = Stochastic disturbance error.

The study was tested at 95% confidence level and 5% significance levels.

#### IV. RESULTS & DISCUSSIONS

##### 4.1 Results

The study received responses from 25 (83.3%) out of the targeted 30 respondents. The response rate of 83.3% was achieved through the support of Google Forms. Mugenda and Mugenda (2003) posit that a response rate of 50% is adequate, 60% is good, and above 70% is very good. Going by this, the response rate in this study was adequate for carrying out study analysis. The reliability of all the items was calculated for all five sub-scales in the questionnaire. The Cronbach's alpha value of 0.97 showed that the questionnaire items were very suitable for data collection, and thus they measured the constructs that they were supposed to measure.

**Table 1**

*Descriptive Statistics for Independent variables*

	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
Team leaders appreciate individual efforts of female engineers	1	4.0%	4	16.0%	11	44.0%	4	16.0%	5	20.0%
Recognition and acknowledgement by employer boosts self-esteem and enhances performance	0	0.0%	0	0.0%	0	0.0%	2	8.0%	23	92.0%
There are equal opportunities for both male and female engineers in the field	7	28.0%	9	36.0%	4	16.0%	2	8.0%	3	12.0%
Female engineers are equally involved in solving technical engineering problems	1	4.0%	7	28.0%	9	36.0%	5	20.0%	3	12.0%
The work environment promotes continuous professional development	1	4.0%	4	16.0%	5	20.0%	5	20.0%	10	40.0%
Periodic professional trainings are mandatory at the work place	5	20.0%	1	4.0%	6	24.0%	4	16.0%	9	36.0%
Qualified female engineers easily get promoted to positions of higher Authority	2	8.0%	12	48.0%	5	20.0%	4	16.0%	2	8.0%
Motivated engineers are likely to be retained	0	0.0%	0	0.0%	5	20.0%	9	36.0%	11	44.0%

As observed above, the individual efforts of female engineers were not appreciated; recognition by employers and seniors boosted the self-esteem of female engineers; opportunities were limited for female engineers; they were not equally involved as their male counterparts; and promotions were not easily obtained.



**Table 2**  
*Descriptive Statistics for Dependent Variable*

	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
There's smooth transition of female engineers from GE>PE>CE	7	28.0%	5	20.0%	11	44.0%	2	8.0%	0	0.0%
There are effective mentorship programs for female graduate engineers	6	24.0%	8	32.0%	7	28.0%	1	4.0%	3	12.0%
Engineering organizations are committed to embracing the gender diversity	3	12.0%	4	16.0%	9	36.0%	6	24.0%	3	12.0%

As observed in Table 3 below, all the independent variables (recognition,  $r=0.897$ ;  $p<0.01$ ; inclusion,  $r=.939$ ,  $p<0.05$ ; continuous professional development,  $r=.935$ ,  $p<0.05$ ; and promotion,  $r=0.922$ ,  $p<0.01$ ) had a strong positive association with the career advancement of female engineers (the dependent variable) as follows:

**Table 3**  
*Correlations between the Dependent and Independent Variables*

		Career advancement of Female Engineers	Recognition	Inclusion	Continuous Professional Development	Promotion
Career advancement of Female Engineers	Pearson Correlation	1	.897**	.939**	.935**	.922**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	25	25	25	25	25

\*\* . Correlation is significant at the 0.01 level (2-tailed).

A multivariate regression model was employed in this study in order to determine the importance of the independent variables with regard to the dependent variable, which is the career advancement of female engineers. This is helpful in determining the statistical significance of the predictor variables used in this study. The study investigated how well the predictor variables would predict the career advancement of female engineers. In Table 4, the R value of .972 shows that there is a strong influence of independent variables on the career advancement of female engineers.  $R^2$  shows that .944 on variation of career advancement of female engineers can be explained by the independent variables.

**Table 4**  
*Model Summary*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.972 <sup>a</sup>	.944	.933	.27506

a. Predictors: (Constant), Promotion, Continuous professional development, Inclusion, Recognition

From Table 5 where  $[F(4, 20) = 84.083, P<.05]$  it is evident that the independent variables influence career advancement of female engineers and thus a significant predictor.

**Table 5**  
*Analysis of Variance*

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.447	4	6.362	84.083	.000 <sup>b</sup>
	Residual	1.513	20	.076		
	Total	26.960	24			

a. Dependent Variable: Career advancement of Female Engineers

b. Predictors: (Constant), Promotion, Continuous Professional Development, Inclusion, Recognition

**Table 6**  
*Coefficients of the Regression Equation*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.396	.675		.587	.564
	Recognition	-.169	.262	-.101	-.643	.527
	Inclusion	.492	.130	.549	3.776	.001
	Continuous Professional Development	.398	.107	.520	3.703	.001
	Promotion	.042	.209	.035	.199	.845

a. Dependent Variable: Career advancement of Female Engineers

Multiple regression was used in order to determine the relationship between career advancement of female engineers and the other variables which were Recognition, Inclusion, Continuous professional development, and Promotion. The multiple linear regression equation model that was fit for this study is,

$$Y = 0.396 + 0.549X_2 + 0.520X_3$$

## 4.2 Discussion

The study investigated how the career advancement of female engineers was impacted by different variables. The results show that an increase in a unit of inclusion results in a 0.549 increase in the career advancement of female engineers, and an increase in a unit of continuous professional development results in an increase of 0.520 in the career advancement of female engineers. These results concur with Bornsen (2012) on the role of training and support networks in the retention and professional advancement of female engineers. Recognition and promotion were not statistically significant, in contrast to a study by Yates and Skinner (2021), which discovered that female engineers' career advancement was hampered by a lack of promotion. On the other hand, inclusion and continuous professional development were found to be key determinants of the career progression of female engineers. Shull and Weiner (2002) agree that continuous training makes female engineers remain motivated and perform better.

Only 2% of the respondents agreed that there was a smooth transition of female engineers from graduate level to professional and consulting, while 28% strongly disagreed. Regarding mentorship, a majority of 32% disagreed that there were effective mentorship programs for female graduate engineers. On the other hand, 36% of the respondents neither denied nor agreed that engineering organizations are committed to embracing gender diversity in the workplace. Acknowledgment from employers and seniors was found to enhance the self-esteem of female engineers. The findings also reveal that opportunities for female engineers were limited, and they were not as involved as their male counterparts. Promotions were also difficult to obtain. Additionally, the individual efforts of female engineers were not valued. These results are supported by numerous studies (Coatesworth, 2015; Hodzic, El Sayed, & Novalic, 2022; and Shull & Weiner, 2002). Female engineers' career advancement was found to be primarily impacted by inclusion. This finding is consistent with Yates and Skinner (2021), who alluded to the fact that bias was detrimental to female engineers' career advancement.

## V. CONCLUSIONS & RECOMMENDATIONS

### 5.1 Conclusions

The results of the study demonstrated a strong correlation between the independent and dependent variables. Inclusion and ongoing professional development training have had a significant impact on the career progression of female engineers. More female engineers would grow professionally and move up the corporate ladder if they were offered equal opportunities with their male counterparts, recognized for their contributions, and given access to continuing professional training. Equal opportunities for all, regardless of gender, should be prioritized, and female engineers should participate in all technical aspects.

### 5.2 Recommendations

#### 5.2.1 Recommendation for Engineering Organizations and Employers

For any professional to advance in their career, and female engineers are no different, continuous professional development is essential. Employers and organizations must encourage periodic training cultures that will motivate female engineers to pursue lifelong learning and actively participate in their fields. Embracing diversity will improve

an organization's team performance, increasing outputs. The professional development of female engineers is negatively impacted by the lack of female mentors in the field; therefore, organizations must implement successful mentoring programs to draw and retain more women. Equal pay for equal work is necessary because female engineers are more likely to be retained in positions that pay well and advance them on par with their male counterparts.

### 5.2.2 Recommendation for Further Studies

Recognition and promotion were left out of the model-fitting process in this study because they did not have statistical significance. Nonetheless, there was a strong positive correlation observed between the two variables and the dependent variable. It is clear from the comments provided by the female engineers who took part in the study that they help female engineers advance in their careers. Further research on the significance of these indicators and how much they affect career advancement would be beneficial. It is also recommended to conduct a similar study on a larger audience to see if comparable outcomes can be achieved.

## REFERENCES

- Alshmemri, M., Akl, L. S., & Maude, P. (2017). Herzberg's Two-Factor Theory. *Life Science Journal*, 14(5). Retrieved from <http://www.lifesciencesite.com/>
- Odera, J. A., & Mulusa, J. (2020). SDGs, Gender Equality and Women's Empowerment: What Prospects for Delivery? (pp. 95-118). Springer. doi:10.1007/978-3-030-30469-0\_6
- African Union. (2013). *The African Women's Decade: Grassroots Approach to Gender Equality and Women's Empowerment*.
- Alfred, M. V., & Rice, D. N. (2014). Personal and Structural Elements of Support for African American Female Engineers. *Journal of STEM Education Innovations and Research*, 15(2).
- Bornsen, S. E. (2012). Motivational and Adaptational Factors of Successful Women Engineers. *North Dakota State University*.
- Bryce, T., & Far, H. (2019). Barriers to career advancement for female engineers in Australia's civil construction industry and recommended solutions. *Australian Journal of Civil Engineering*, 17(1).
- Coatesworth, M. G. (2015). Women staying in STEM professions long-term: A motivation model. *The University of the Rockies ProQuest Dissertations Publishing*. Retrieved from <https://www.proquest.com/openview/3db868f01717d93b9623832d8b1d2bcb/1?pq-origsite=gscholar&cbl=18750>
- Government of Kenya (GoK) (2010). *The Constitution of Kenya 2010*. Nairobi: Government Printer.
- Dandona, A. (2015). Empowerment of Women: A conceptual Framework. *The International Journal of Indian Psychology*, 2(3).
- Dutta, D. (2015). Sustaining the Pipeline: Experiences of International Female Engineers in U.S. Graduate Programs. *Journal of Engineering Education*.
- Fouad, N., & Singh, R. (2011). *Stemming the tide; Why Women Leave Engineering*. University of Wisconsin-Milwaukee.
- Fouad, N., Fitzpatrick, M., & Liu, J. P. (2011). *Journal of Women and Minorities in Science and Engineering*, 17(1), 69-96.
- Hodzic, E., El Sayed, A., & Novalic, A. (2022). Motivation of Female Engineers in the Construction Industry in Bosnia and Herzegovina. *Engineering, Technology and Applied Research*, 12(5). doi:10.48084/etasr.5142
- Jones, N. B., & Lloyd, G. C. (2005). Does Herzberg's motivation theory have staying power? *Journal of Management Development*, 24(10), 929-943.
- Kaewsri, N., & Tongthong, T. (2013). Professional Development of Female Engineers in the Thai Construction Industry. *Science Direct*, 88, 291-298.
- M. Kaltenborn et al. (2020). *Sustainable Development Goals and Human Rights, Interdisciplinary Studies in Human Rights 5*. doi:doi.org/10.1007/978-3-030-30469-0\_6
- Maskey, N. (2018, December). The Future of Women in Engineering: Why Businesses Need to Invest in Education Female Engineers [Career Advisor]. *IEEE Women in Engineering Magazine*, 12(2), 42-C3.
- Mugenda, A., & Mugenda, O. (2003). *Research Methods: Qualitative and Quantitative Approaches*. Nairobi: Africa Centre for Technology Studies (ACTS).
- Nina, J. (2022). Understanding the experiences of female career advancement in engineering. In *Masters Thesis*. University of the Western Cape. Retrieved from <https://etd.uwc.ac.za/handle/11394/9642>



- Ogechi, A. (2020). The Digital Gender Divide and Women's Empowerment in Sub-Saharan Africa: Achieving the UN's 2030 Sustainable Development Goals. *Empowering African Women for Sustainable Development*.
- Rahimi, I., Divsalar, K., Rezvani, M., Aramoon, S. S., & Pourranjbar, M. (2016). The Relationship between Lifeguards' Needs and Their Job Satisfaction Based on Maslow's Hierarchy of Needs. *Report of Healthcare*, 2(2), 23-30. Retrieved from [https://jrhc.marvdasht.iau.ir/article\\_2711\\_5f8015f0a0350d79e7ddd2d837327044.pdf](https://jrhc.marvdasht.iau.ir/article_2711_5f8015f0a0350d79e7ddd2d837327044.pdf)
- Shull, P. J., & Weiner, M. (2002). Thinking Inside the Box: Self-Efficacy of Women in Engineering\*. *International Journal of Engineering Education*, 18(4), 438-446.
- Sridevi, J. (2016). Corporate Social Responsibility Towards Women Empowerment. *International Journal of Administration and Governance*, 1(5), 35-37.
- UN Women. (2022). In focus: Sustainable Development Goal 5; achieving gender equality and empowering all women and girls. *UN Women*. Retrieved from <https://www.unwomen.org/en/news-stories/in-focus/2022/08/in-focus-sustainable-development-goal-5>
- Yates, J., & Skinner, S. (2021). How do female engineers conceptualise career advancement in engineering: a template analysis. *Career Development International*, 26(5), 697-719. doi:10.1108/cdi-01-2021-0016