Motivation of Female Engineers in the Construction Industry in Bosnia and Herzegovina

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Abstract-Female engineers go through different stages during their professional careers due to natural life processes and factors. In developing countries, it is not rare for managers to avoid hiring female engineers, due to these factors and the conservative belief that construction is a male-dominated industry. In Bosnia and Herzegovina (B&H) there are a few studies that refer to the motivation in the construction industry, but none that refer to the position of women in the construction industry and their motivation based on the selected demographic factors. This study aims to fill this research gap, utilizing quantitative research methods. The sample included female engineers of different profiles, working in the construction industry, who were required to fulfill the Multidimensional Work Motivation Scale (MWMS). The five considered demographic factors are age, family status, number of children, education level, and professional experience. The results of this research showed that family status does not affect any motivation dimension, whereas professional experience affects all motivation dimensions except the identified regulations. External–material regulations consist the most influential motivation dimension for female engineers in the construction industry in B&H, whereas amotivation, and introjected regulations were the least. It is recommended for managers and human resources to use the findings of this research in order to keep the female construction engineers motivated and satisfied in their workplace or to know what motivation dimensions to use during the hiring process.

Keywords-motivation; female engineers; construction industry; Bosnia and Herzegovina

I. INTRODUCTION

Motivation is an important factor, but yet it is a vague concept in work [1]. Various profiles of engineers require diverse motivation systems, but there is not a standard motivation model that could be used for all engineers. The reason for that is that the profiles of engineers change over time, due to the nature of human life. In Bosnia and Herzegovina (B&H) only a few studies refer to the motivation in the construction industry [2]. To the best of our knowledge, there is no study that refers to the motivation of women in the construction industry, based on specific demographic factors. That is why this study will fill that research gap and aims to find out what motivates female construction engineers in B&H. A relevant study that was conducted in Nigeria resulted that financial reward is mostly used to motivate supervisors, whereas contractors prefer nonfinancial incentives. An important result is that in Nigeria construction industry, motivation of workers is not related to their needs [3]. The motivational factor that has the largest influence on female engineers is good work discipline, whereas the leading factor for motivation of male engineers is company name and stability [4]. Authors in [5] discovered 5 key motivational factors: achievement, proper recognition and awards, interesting work, involvement in decision making, and adequate training and development. During the last 50 years, the productivity in construction has remained low and when compared to other industries it can be said that the construction industry has fallen behind [6]. The top five most frequent problems that women in construction encounter are [7]:

- Slow advancement in career that leads to disappointment with the industry and construction culture.
- Difficulties with work–family balance.
- Attitude barriers that were the result of the male workers' domination in the construction industry.
- "Job hopping" to overcome barriers caused by slow progress and inflexible work structure.
- The culture because it consists of disputes, aggression and large percentage of men.

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Still, the main reason why women are withdrawing from the construction industry and why women are not looking at it as viable career is culture. The potential solution for this, offered by some papers, is that the substantial change in the culture of the construction industry and its first impression will be needed in order to bring and keep large number of women at all levels [7].

A. Female Engineers in the Construction Industry

When the construction industry exhibited the greatest degree of vertical segregation by sex, women were less than 1% of the employed in construction trades in UK [8]. Construction's negative public image is that it is dirty and dangerous which results in a decrease of women's participation [9]. It is interesting to mention that previously conducted studies on women's construction careers did not reflect the nature of women's careers and why women encounter barriers more often and advance more slowly than their male coworkers [10]. A lawsuit was filed against the USA Department of Labor for its failure to fulfill its duties that prohibit discrimination in employment decisions on the basis of race, religion, gender, or national origin for federal construction contractors and subcontractors who do over $10,000 in government business in one year. This action resulted in the establishment of regulations that were issued to integrate women into the construction industry by requiring specific steps [11].

Three out of five women that were interviewed in [12] stated that they had experienced harassment on the construction site, such as whistling, cat calls, a constant feeling to prove oneself, and so on. Career frustration and increased intentions to leave the industry are some of the factors that have been connected to the lower number of entries of female engineers in the construction industry [13]. It is important for construction managers to understand that what motivates male engineers, does not have to apply for female engineers. Women have different perceptions and priorities than male engineers, which results in different ways of motivation [14]. Promotion of STEM (Science, Technology, Engineering, and Mathematics) careers is more common these days than it was in the past. But there are not so many opportunities to bring in and explain construction management to new generations. So again, girls are deprived because chances are quite low for them to have some practical experience with construction or buildings design in comparison to the boys [15]. The main focus on how to transform the construction industry is through building relationships between the industry itself and universities [16, 17]. In the education process, ways to motivate workers should also be included because having qualified manpower is very important for the achievement of quality [18].

Effective construction project management is crucial in order to have good performance [19]. Employers could support female engineers in construction management by making the environment more respectful for them. It is concluded that it is imperative for the management to support women, create respectful environment with zero tolerance for harassment and try to provide them quality training opportunities in order for them to grow and develop their professional career [12].

B. Maslow's Theory

Motivation gives a goal that a person seeks to achieve. Every person has that need and if that need is withheld it will have a mobilizing effect, and if satisfied, a new goal of satisfying a new need on the hierarchy will be set [20]. Two main conclusions that can be derived from Maslow's need hierarchy are [21]:

- Satisfaction of one need does not serve as motivator.
- When needs on the lower part of the hierarchy become satisfied, then the next needs on the hierarchy determine the person's behavior.

Authors in [22] used motivation factors from Maslow's theory in the construction industry. It can be said that motivation is a main reason for the increased productivity of workers. It consists of powers and mechanisms that serve to direct a person's behavior in a desired way. This means that all the activities in the purpose of convincing and encouraging workers are the reasons they do their tasks willingly.

C. The Effect of Demographic Factors on Motivation

The relationship between motivation factors and gender in the case of engineers in the construction industry was tested in [14]. The results of that research showed no difference in the factors that motivate and demotivate them. It was also concluded that different things attract males and females to the workplace. The findings of [23] state that the age has very low level of influence on motivation, while education level has a large impact on achieving organizational goals. The professional qualification does have an influence on motivation, even when in relation with professional experience. Additionally, the overall motivation is not statistically impacted by the relationship between the age of the workers and the years they spent in a company. It is important to add that safety is the only motivational factor that depends on the age of the respondents because employees with different professional experiences do not have similar attitudes towards safety [23]. Factors such as the working hours, recognition received for a job well done, and colleague relationships play a major role in motivating engineers [24].

D. Literature Review Summary

The summarized findings of the literature review are:

- The motivational factor that has the most influence on female engineers is the good discipline at work.
- It is imperative for the management to support women in construction industry by:

1. Creating respectful environment with zero tolerance for harassment (solving the "being ignored at meetings" issue).
2. Providing quality training opportunities for continued professional development.

- Professional qualification has an influence on motivation, but none when in relation with professional experience.
- Safety is the only motivational factor that depends on the age of employees.

II. RESEARCH METHODOLOGY

The target population for this study consists of female engineers in Bosnia and Herzegovina that work or are educated in construction related fields. They have to have at least a bachelor's degree in construction related fields such as architecture, civil, mechanical, or electrical engineering. No other minimal requirements were taken into consideration. Sampling included all kinds of construction companies, architecture studios, schools, universities, and all other job positions where female construction engineers work. Snowballing technique was used. No names will be mentioned for confidentiality reasons.

Data collection started on 18th of December, 2021. The questionnaire consisted of the Multidimensional Work Motivation Scale (MWMS) with a total of 19 items and 5 demographic factors. The questionnaire was made by using google forms, and all questions were marked as required fields to be answered. Questions were answered in a Likert scale of 5 points, ranging from 1 for strongly disagree to 5 for strongly agree [25]. The online questionnaire was made in English and Bosnian. On the 13th of March, 2022 there were 200 respondents who filled out the questionnaire. The data collection process lasted for 2 months and 26 days.

Due to the established effect of demographics on the motivation in the literature findings and because women go through different phases in life, from being only a worker to being a worker, wife, and a mother by going through physical and mental changes, the following demographic factors were chosen in order to find solutions to the research problem: age, family status, number of children, educational level, and professional experience. The hypotheses assumed in this study, are:

- Hypothesis 1 (H1): Professional experience, as a demographic factor of female construction engineers in B&H, has a larger effect on intrinsic regulations than on other motivation dimensions.
- Hypothesis 2 (H2): Education level, as a demographic factor of female construction engineers in B&H, has a larger effect on external regulations - social than on other motivation dimensions.
- Hypothesis 3 (H3): Family status, as a demographic factor of female construction engineers in B&H, has a larger effect on external regulations - material than on other motivation dimensions.
- Hypothesis 4 (H4): Family status in relation with the number of children has a larger effect on identified regulations than on other motivation dimensions.
- Hypothesis 5 (H5): Education level in relation with professional experience has a larger effect on external regulations - social than on other motivation dimensions.

The research questions of this paper are:

1. The demographic factor amotivation, as a motivation dimension for female engineers in construction industry in B&H, could be used?
2. The demographic factor external regulations - social, as motivation dimension for female engineers in construction industry in B&H, could be used?
3. The demographic factor external regulations – material, as motivation dimension for female engineers in construction industry in B&H, could be used?
4. The demographic factor introjected regulations, as motivation dimension for female engineers in construction industry in B&H, could be used?
5. The demographic factor intrinsic regulations, as motivation dimension for female engineers in construction industry in B&H, could be used?
6. Which demographic factor is the most common and which is the least common effect on motivation dimensions of MWMS scale for female construction engineers in B&H?
7. What motivation dimension is most widely used for motivating female construction engineers in B&H and what the least?

In this paper, the motivational dimensions are the dependent variables and the demographic factors the independent variables, meaning that the motivational dimensions used in this research depend on the demographic factors. There are 19 items that are sorted in 6 different dimensions in the MWMS [26]:

1. Amotivation
2. External material regulations
3. External social regulations
4. Introjected regulations
5. Identified regulations
6. Intrinsic motivation

The MWMS dimensions and their questions are given below [26].

A. Amotivation

MWMS1: I don't put any effort on the current job, because I really feel that I'm wasting my time at work.

MWMS2: I do put a little effort on the current job, because I don't think this work is worth putting efforts into.

MWMS3: I don't put any effort on the current job, because I don't know why I'm doing this job, it is a pointless job.

B. External Regulations - Social

MWMS4: I put an effort in the current job to get others' approval (e.g. supervisor, colleagues, family, clients).

MWMS5: I put an effort in the current job because others will respect me more.

MWMS6: I put an effort in the current job to avoid being criticized by others.

C. External Regulations - Material

MWMS7: I put an effort in the current job because others will reward me financially only if I put enough effort in it (e.g. employer, supervisor).

MWMS8: I put an effort in the current job because others offer me greater job security if I put enough effort in it.

MWMS9: I put an effort in the current job because I risk losing my job if I don't put enough effort in it.

D. Introjected Regulations

MWMS10: I put an effort in the current job because I have to prove to myself that I can.

MWMS11: I put an effort in the current job because it makes me feel proud of myself.

MWMS12: I put an effort in the current job because otherwise I will feel ashamed.

MWMS13: I put an effort in the current job because otherwise I will feel bad about myself.

E. Identified Regulations

MWMS14: I put an effort in the current job because I personally consider it important to put efforts in this job.

MWMS15: I put an effort in the current job because putting efforts in this job aligns with my personal values.

MWMS16: I put an effort in the current job because putting efforts in this job has personal significance to me.

F. Intrinsic Motivation

MWMS17: I put an effort in the current job because I have fun while doing it.

MWMS18: I put an effort in the current job because what I do in my work is exciting.

MWMS19: I put an effort in the current job because the work I do is interesting

III. RESULTS AND DISCUSSION

Tests for analyzing the hypotheses will be chosen based on the types of included variables. Regression test will be used for the hypotheses where an independent continuous variable affects a dependent continuous variable. When an independent categorical variable affects a multiple dependent continuous variables, the one-way MANOVA (multivariate analysis of variance) will be applied, whereas MANCOVA (multivariate analysis of covariance) will be applied when categorical and continuous variables affect multiple dependent continuous variables. The dependent variables are amotivation, external regulations – social, external regulations – material, introjected regulations, identified regulations, and intrinsic regulations. A total of 200 female engineers filled out the questionnaire. Those engineers are architects, civil engineers, electrical engineers and mechanical engineers. The demographic questions were year of birth, family status, number of children, educational level, and professional experience. The range of respondents' years of birth is 1959-1999. This shows that there is a 40-year difference between the youngest and the oldest female engineer in the construction industry that participated in this research.

A. Reliability

For testing and measuring reliability, Cronbach's alpha coefficient was used. IBM SPSS statistics software showed the results of the reliability test and the results of Exploratory Factor Analysis (EFA). Cronbach's alpha for all dimensions ranges from 0.759-0.922. Reliability is good if Cronbach's alpha values are higher than 0.7 [27]. A conclusion can be made that the alpha coefficients are reliable as they are all higher than 0.7 (Table I). The minimum accepted loading of EFA is 0.4 [28]. The analysis was carried out for all items of 6 the dimensions of MWMS. The EFA results showed that all correlations (loadings) for the given items regarding all variables in the MWMS scale are above the minimum value of 0.4. This shows that the validity of the questionnaire for all variables is satisfactory.

TABLE I. CALUES OF CRONBACH'S ALPHA COEFFICIENT AND INTERNAL CONSISTENCY [27]

Cronbach's alpha	Internal consistency
$\alpha \geq 0.90$	Excellent
$0.90 \geqslant \alpha \geqslant 0.80$	Good
$0.80 \geq \alpha \geq 0.70$	Acceptable
$0.70 \geq \alpha \geq 0.60$	Questionable
$0.60 \geq \alpha \geq 0.50$	Poor
$0.50 < \alpha$	Unacceptable

B. Testing the Hypotheses

In statistics, it can be stated that the population mean lies within a 95% confidence interval. This means that as an approximate population number, the mean of the sample size can be used [29]. The following significant terms are used in reporting [29]:

- $p < 0.05$ (significant at 5%) "The difference was significant"
- $p < 0.01$ (significant at 1%) "The difference was highly significant".

1) Testing Hypothesis 1

Professional experience, as a demographic factor of female engineers in B&H construction industry, has a larger effect on intrinsic regulations than on other motivation dimensions. In the case of Hypothesis 1, the independent discrete variable is professional experience, whereas motivation dimensions are dependent continuous variables, linear regression was used for testing. The confidence interval is 95%. The significance level or P-value is higher than 0.05 for all factors, except for identified regulation, which is 0.126 which means that professional experience has no significant effect on identified regulations [29]. This leads to the conclusion that the identified regulations should not be used as a motivation dimension regarding the professional experience of female engineers in the construction industry. The value of R-square will tell the strength of correlation.

TABLE II. CORRELATION OF DETERMINATION [30]

R-squared value	Strength of association
$r^2=0$	No correlation
$0 < r^2 < 0.25$	Very weak correlation
$0.25 \leq r^2 < 0.50$	Weak correlation
$0.50 \leq r^2 < 0.75$	Moderate correlation
$0.75 \leq r^2 < 0.90$	Strong correlation
$0.90 \leq r^2 < 1$	Very strong correlation
$r^2=1$	Perfect correlation

TABLE III. HYPOTHESIS 1 - R SQUARE & ASSOCIATION STRENGTH

Dependent variables	Independent variable: Professional experience		
	R square	Adjusted R square	Strength of association
Amotivation	0.015	0.010	very weak
External regulations-social	0.044	0.040	weak
External regulations-material	0.051	0.046	weak
Introjected regulations	0.020	0.015	very weak
Intrinsic regulation	0.059	0.054	moderate

When comparing the adjusted R square of the dependent variables, it can be said that intrinsic regulations is the most associated with the other motivation dimensions. It has a moderate correlation with the age of female engineers. Based on the results in this section, it can be concluded that Hypothesis 1 is accepted.

2) Testing Hypothesis 2

Education level, as a demographic factor of female engineers in B&H construction industry, has a larger effect on external regulations - social than on other motivation dimensions. Education level is, as a family status, a categorical independent variable. The hypothesis of the effect of the independent categorical variable on dependent continuous variable will be tested and one-way MANOVA was used. The results showed that education level, as a demographic factor of female engineers in the construction industry in B&H, affects both external regulations, but does not affect any other motivation dimension. Since both external regulations are affected by the education level, then the amount of effect that education level has on them should be measured.

TABLE IV. PARTIAL ETA SQUARED - EFFECT SIZE [29]

Partial eta squared	Effect size
0.01	Small effect
0.06	Moderate effect
0.14	Large effect

TABLE V. PARTIAL ETA SQUARED – HYPOTHESIS 2

Dependent Variables	Association strength
External regulations-social	0.091
External regulations-material	0.054

The effect of education level on external regulation – material is small, very close to being moderate. On the other side, external regulations – social is moderately affected by the education level, since partial eta squared is larger than 0.06 [29]. From the results and the information presented in this section, it can be stated that Hypothesis 2 is accepted.

3) Testing Hypothesis 3

Family status, as a demographic factor of female engineers in B&H construction industry, has a larger effect on external regulations - material than on other motivation dimensions. After the conducted MANOVA, the significance level is one of the most important parts of the results. Those results are shown in Table VI. Based on them, it can be seen that family status does not affect any motivation dimension if confidence interval is 95% [29]. Then, Hypothesis 3 is rejected.

TABLE VI. ONE-WAY MANOVA RESULTS - HYPOTHESIS 3

Dependent Variables	Significance value
	Number of children
Amotivation	0.110
External regulations-social	0.184
External regulations-material	0.272
Introjected regulations	0.850
Identified regulations	0.071
Intrinsic regulations	0.072

4) Testing Hypothesis 4

Family status in relation with the number of children has a larger effect on identified regulations than on other motivation dimensions. MANCOVA will be used for this hypothesis because independent variables are categorical and continuous and affect multiple dependent continuous variables. Table VII shows the MANCOVA results. When the number of children and family status are in relation, they do not have an effect on any motivation dimension [29]. With that result, Hypothesis 4 is rejected.

TABLE VII. ONE-WAY MANCOVA RESULTS - HYPOTHESIS 4

Dependent variables	Significance value	
	Family status	Number of children
Amotivation	0.333	0.592
External regulations-social	0.488	0.491
External regulations-material	0.393	0.093
Introjected regulations	0.817	0.613
Identified regulations	0.624	0.076
Intrinsic regulations	0.580	0.119

5) Testing Hypothesis 5

Education level in relation with professional experience has a larger effect on external regulations - social than on other motivation dimensions.

TABLE VIII. ONE-WAY MANCOVA RESULTS - HYPOTHESIS 5

Dependent variables	Significance value	
	Education level	Professional experience
Amotivation	0.646	0.295
External regulations-social	0.004	0.318
External regulations-material	0.147	0.076
Introjected regulations	0.661	0.215
Identified regulations	0.331	0.577
Intrinsic regulations	0.840	0.007

The results show that education level in relation with professional experience does not affect external regulations – material as it did on its own. It affects only external regulations – social. Professional experience in relation with education

level affects only intrinsic regulations, whereas on its own it affects all regulations except the identified regulations. As mentioned, education level in relation with professional experience affects only external regulations – social [29]. This leads to the conclusion that Hypothesis 5 is accepted.

6) Research Questions

Amotivation could only be used for female engineers with regard to their professional experience. The findings state that external regulations – social, as motivation dimension, is the most useful for motivating with regard to the education level of female engineers in the construction industry in B&H. External regulations – material is affected by all demographic factors except family status. This means that this motivation dimension could be used for any of these demographic factors. Based on the results, introjected regulations could only be used for motivating when it comes to professional experience. For all demographic factors except family status and education level, intrinsic motivation regulations could be used. Family status does not affect any motivation dimension, whereas professional experience affects all motivation dimensions except the identified regulations. External – material regulations is the most influential motivation dimension for female engineers in the construction industry in B&H, whereas identified regulations, amotivation, and introjected regulations are used the least.

7) Summary

This section will show the comparison between the findings of the current research and the literature findings.

TABLE IX. RESULTS COMPARISON WITH LITERATURE FINDINGS

Research results	Literature findings
External – material regulations have the most impact on motivation dimension for female engineers in construction industry in B&H	The motivational factor that has the most influence on female engineers is good discipline at work
Both external regulations are affected by education level, but when in relation with professional experience it affects only external regulations - social	Professional qualification has an influence on motivation, but none when in relation with professional experience

Table X shows the status of hypothesis testing and the explanations in case a hypothesis was rejected.

TABLE X. HYPOTHESES RESULT SUMMARY

Hypothesis	Status	Association
H1	Accepted	Moderate association (adjusted R square)
H2	Accepted	Moderate association (partial eta squared)
H3	Rejected	Family status does not affect any motivation dimension
H4	Rejected	Family status and number of children in relation do not affect any motivation dimension
H5	Accepted	Decreased association with external regulations – social (from moderate when on its own to weak when in relation).

IV. CONCLUSION

When education level is used as a demographic factor of female construction engineers in B&H, both external regulations could be used for motivation. Intrinsic regulations is the most associated with professional experience than other motivation dimensions, since it has moderate association. Family status does not affect any motivation dimension, whereas professional experience affects all motivation dimensions except the identified regulations. External – material regulations is the most influential motivation dimension for female engineers in the construction industry in B&H, whereas identified regulations, amotivation, and introjected regulations are used the least.

To the best of our knowledge, there are no studies that refer to the motivation of women in the construction industry in B&H, based on the selected demographic factors. The current study fills that research gap. The results of this research could be used in construction companies in order to motivate their female engineers. Regarding the demographic factors used, the motivation dimension for each employee should be found. It would be a duty of management or human resources to update these applications as female engineers go through different stages in their professional careers due to natural life processes and factors and their motivation regulation might change. Hopefully, many female engineers in the construction industry in B&H may find this research useful to find ways of self-motivation. When analyzing whether to stay in the construction industry or how to develop their career, this research may lead to desired outcomes for female construction engineers. Additionally, managers and human resources can now find what motivates their female construction engineers in order to keep them satisfied in their workplace or to know what motivation dimensions to use during the hiring process.

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