

Investigating factors affecting the improvement of professional ethics of civil engineers (case of study: civil engineers in the construction industry)

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ABSTRACT:

Professional ethics in civil engineering has always been the focus of experts due to its direct relationship with people's lives and health. This is despite the existence of ethical codes and existing supervisions, compliance with professional ethics is still facing many ups and downs. Therefore, the current research has investigated the factors affecting the improvement of professional ethics of civil engineers in the construction industry with an analytical-descriptive approach. The statistical population of this study is the civil engineers of Yasuj city with at least 5 years of experience in the construction industry, and the sample size was determined to be 221 people based on the Cochran formula. The method of collecting information in the theoretical part is based on library studies and in the field part is based on questionnaires. The reliability of the questionnaire was checked based on Cronbach's alpha formula and its validity was checked based on confirmatory factor analysis. In addition, data analysis was done based on structural equation method and using Smart PLS 3 software. The results indicate that the effect of the variables of personal attitudes and professional qualifications of engineers on improving the professional ethics of civil engineers in the construction industry is positive and significant. Also, the variable of how to evaluate and compensate services has a moderating effect on the relationship between the personal and personal attitudes of engineers and the professional qualifications of engineers with the improvement of professional ethics of civil engineers in the construction industry.

Keywords: professional ethics, civil engineering, construction industry

I. INTRODUCTION

Engineering ethics is one of the topics that has attracted the attention of the engineering community in recent years, and today, with the rapid development of technology and the expansion of engineering activities, the need to pay attention to it is felt more than ever. But what ethical issues and engineering activities links them together, is that both are focused on the engineer's behavior. The professional behavior of engineers is usually affected by multiple factors, which should be considered in engineering ethics discussions (Davis, 2017). Specialists in the field of civil engineering, as one of the branches of the engineering group, deal with the design, maintenance and construction of artificial structures such as buildings, bridges, roads and passages, dams, etc. Yaqoubinejad et al. (2003) are of the opinion that the good manners of civil engineers is a human virtue for them. Abubasheri et al. (2004) emphasized the necessity of paying attention to ethics and using ethical regulations for civil engineers. Hijazi (2010), emphasizing the need to pay attention to the knowledge, ability and ethics of engineering, considered the most important ethical and ritual characteristic of engineers to be the watcher of the world. Jodaki and EjalLuian (2016), also in their study about ethical challenges in construction workshops, the lack of knowledge of engineers about ethical regulations and insufficient training at this university level and the low level of engineering ethics regulations are the cause of ethical challenges in This workshop and the emergence of consequences such as reducing the job satisfaction of employees and creating an unfavorable experience for them.

Abdurrahman et al. (2011), in their review of the professional ethics of engineers in the construction industry, identified fraud, bribery and tender collusion, underwork, waste of time and disappointing performance, fraud, ingratitude and cooperation with the competitor as the main unethical behaviors were introduced by competitors. The review of the studies conducted regarding the professional ethics of civil engineers shows that while the codes of ethics related to the professional ethics of civil engineers have not been given as much attention and implemented as they deserve, civil engineers, due to their direct relationship with humans, They have his life and safety. Therefore, the present study was conducted with the aim of investigating the factors affecting the improvement of the professional ethics of civil engineers in the construction industry. It seeks to answer these main questions: 1) What effect do engineers' personal and personal attitudes have on improving the professional ethics of civil engineers in the construction industry? 2) What effect do the professional qualifications of engineers have on improving the professional ethics of civil engineers in the construction industry? 3) How is the method of evaluating and compensating services based on the relationship between the personal and personal attitudes of engineers and the professional qualifications of engineers with improving the professional ethics of civil engineers in the construction industry?

II. THE THEORETICAL FRAMEWORK OF THE RESEARCH

Ethics is the plural of the word "nature" and means behavior, character, and mood.

Therefore, the knowledge of examining and valuing human temperament and behavior is called "Ethical Science" and in any profession, including engineering, these rules are a guide and supporter of employees. (Jodaki and Ajlovian, 2015). Professional ethics means knowing and acting on the moral responsibilities that every real or legal person has towards others (Park et al., 2014:66). Professional ethics is a set of principles and standards of human behavior that determine the behavior of individuals and groups. In fact, professional ethics is a rational thinking process whose purpose is to determine the organization's values. Organizations' inattention to work ethics and weakness in observing ethical principles in dealing with the organization's human resources and external stakeholders can create problems for the organization and question the legitimacy of the organization and its actions (Davis, 2017).

Being professional in ethics means knowing a set of human behavior criteria that determine the behavior of individuals and groups in a professional structure, the concept of which is derived from ethics (Lee et al., 2019). In fact, being professional in ethics means knowing a set of criteria of human behavior that determines the behavior of individuals and groups in a professional structure whose concept is derived from ethics. In other words, it is a set of ethical rules derived from the professional nature of the job. A creative professional deals with how a person behaves when performing a task. Cadozir (2002), is of the opinion that people with the characteristic of professional ethics have the following characteristics:

Table 1 - Factors affecting the professional ethics of civil engineers

Summary description	Attributes
The general competence of the engineering profession is: fair behavior - honesty and correctness - confidentiality before - during and after work - work quality control - conscientiousness	Glaser (1989)
The specific qualifications of the civil engineering field are: performing engineering services in accordance with laws and regulations - being truthful in statements - paying attention to regulations and standards - high managerial ability in project management-	Imanzadeh et al. (2018)
Economic factors and the lack of an independent regulatory system, the lack of job security for engineers are among the most important obstacles in not realizing the professional moral competence of civil engineers.	Zahor and Collaborator ((2010
Economic factors and the lack of an independent regulatory system, the lack of job security for engineers are among the most important obstacles in not realizing the professional moral competence of civil engineers.	(Kaizi et al. (2001

The following are necessary for the crystallization of professional ethics in civil engineers: acceptance of efficient human resources, planning for optimal use of the forces, meritocracy and fairness in selection and recruitment.	Shahid Razi (2013)
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Based on this, the purpose of professional ethics is to accept and act on the moral responsibility that a person has in his job. Because different businesses and professions have different ethical standards according to their sensitivity and duties in the society. Therefore, every profession must have its own ethical and legal guidelines and its regulations must be committed to these ethical and legal standards in order to gain the confidence and trust of all people (Lawrence, 2019: 680).

III. CONCEPTUAL MODEL AND RESEARCH ASSUMPTIONS

Based on the theoretical foundations and studies conducted in the previous research, the conceptual model shows that engineers are related

to three different ethical fields: 1) Technical ethics, which are taken about technical and scientific decisions; 2) Professional ethics related to other engineers, managers and employees and workers; 3) Social ethics, which is related to national and patriotic commitments and human society. Based on this, according to the results of the library studies, it can be acknowledged that the professional qualifications of civil engineers under the influence of their individual and personality characteristics and the monitoring and evaluation system of independent engineers lead to the improvement of the professional ethics of civil engineers in the industry. It becomes a building. Therefore, the framework or conceptual model of the current research is as follows:

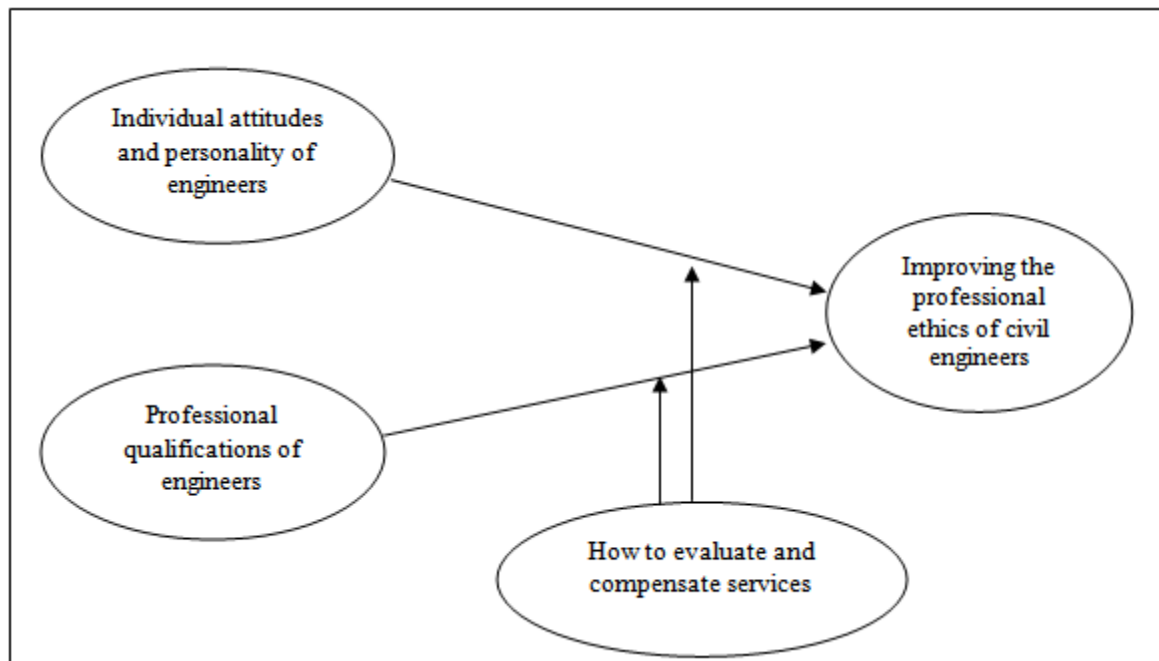


Figure 1- The conceptual model of the research

Research assumptions

Hypothesis 1) Personal and behavioral characteristics have a significant effect on improving the professional ethics of civil engineers.

Hypothesis 2) Values, beliefs and attitudes have a significant effect on improving the professional ethics of civil engineers.

Hypothesis 3) Professional qualifications have a significant effect on improving the professional ethics of civil engineers.

Hypothesis 4) General qualifications have a significant effect on improving the professional ethics of civil engineers.

Hypothesis 5) The way of service evaluation and compensation has a moderating effect on the relationship between personal and behavioral

characteristics on the improvement of professional ethics of civil engineers.

Hypothesis 6) How to evaluate and compensate for services has a moderating effect on the relationship of values, beliefs and attitudes on improving the professional ethics of civil engineers.

Hypothesis 7) The way of evaluation and compensation of services has a moderating effect on the relationship of professional qualifications on the improvement of professional ethics of civil engineers.

Hypothesis 8) The way of evaluation and compensation of services has a moderating effect on the relationship of general qualifications on the improvement of professional ethics of civil engineers.

IV. RESEARCH METHODOLOGY

The current research is one of the types of applied research with a quantitative approach and based on a survey and correlation strategy, which was carried out in a single section. The statistical population of this study is civil engineers active in the construction industry in Yasouj, who have at least 5 years of experience in this industry. The

sample size was determined to be equal to 221 using Cochran's formula. In the research, in order to formulate the theoretical framework of the research from the library method and in order to collect field information, a standard questionnaire tool based on the Likert scale was used. In the current research, it was used to ensure the validity of the tool. The construct validity of this research will be investigated using divergent validity and convergent validity. Cronbach's alpha coefficient was also used to measure the reliability of the questionnaire. The analysis of statistical data and the investigation of research hypotheses was done by the method of structural equation analysis using SPSS and Smart-PLS3 statistical software.

V. RESEARCH FINDINGS

The statistical description of the data is a step towards identifying the pattern governing them and a basis for explaining the relationships between the variables used in the research. According to the results of the first part of the questionnaire (demographic characteristics), the following information is summarized in Table No. 2:

Table 2- Descriptive findings

relative abundance (percentage)	absolute frequency (number)		
92	195	Man	gender
18	26	Female	
9	21	Less than 30 years	Age
44	97	Between 31 and 45 years	
37	81	Between 46 and 60 years	
10	23	Older than 55 years	
61	135	Bachelor's degree	education
35	78	Master's degree	
4	8	P.H.D	
40	85	Less than 5 years	work experience
27	63	Between 6 and 10 years	
22	49	Between 11 and 20 years	
11	24	Between 21 and 30 years	

Checking the assumption of normality of the data

Non-parametric tests such as the Kolmogorov-Smirnov (ks) test should be used for data analysis in researches that are carried out at the level of nominal and rank scales. In this research, the Kolmogorov-Smirnov goodness of fit test was used to check the normality of the observations. The hypothesis examined in this test is as follows:

When checking the normality of the data, we test the null hypothesis that the distribution of the data

is normal at the 5% error level. For the normality test, the statistical assumptions are set as follows:

H0: The distribution of data related to each of the variables is normal

H1: The distribution of data related to each of the variables is not normal

Therefore, if the test statistic is greater than 0.05, then there will be no reason to reject the null hypothesis. In other words, the data distribution is normal

Table 3- Kolmogorov-Smirnov test

The result of the test	z statistic	meaningful	standard deviation	Average	Statistics Variables
Reject the null hypothesis	1.291	0.076	0.487	3.547	Individual and behavioral characteristics
Reject the null hypothesis	1.237	0.130	0.625	4.523	Values, beliefs and attitudes
Reject the null hypothesis	1.369	0.086	0.421	3.524	Professional qualifications
Reject the null hypothesis	1.497	0.102	0.587	4.367	General qualifications
Reject the null hypothesis	1.184	0.061	0.512	3.627	How to evaluate and compensate services
Reject the null hypothesis	1.148	0.129	0.721	3.443	Improving the professional ethics of civil engineers

According to table (3), the significant value (Sig) for the data, as well as the placement of the Z statistic with a confidence level of 95% and an error of less than 5% outside the range of +1.96 to -1.96, with 95% confidence, we can claim to reject the H0 hypothesis. became. Therefore, non-parametric tests and structural equation tests using Smart PLS software can be used because they are not sensitive to the normality of the data.

Validation of research measurement tools

The first factor that should be considered in the evaluation of reflective models is the one-

dimensionality of the indicators. This means that each indicator in the total of indicators should be loaded with a large factor loading value on only one dimension or latent variable. In order to analyze the data using PLS software, the two-step method of Holland (1999) is used for partial least squares modeling. The first stage includes determining the measurement model through reliability and validity, and the second stage includes determining the structural model through the analysis of fit indices, coefficients of determination, and path analysis.

Table 4- validity and reliability of the measurement model

Variables	Cronbach's alpha	CR	Rho coefficient	AVE	AVEConvergent validity
Individual and behavioral characteristics	0/712	0/838	0/766	0/627	0/767
Values, beliefs and attitudes	0/823	0/876	0/851	0/761	0/869
Professional qualifications	0/735	0/897	0/756	0/659	0/895
General qualifications	0/786	0/883	0/844	0/687	0/875

How to evaluate and compensate services	0/824	0/884	0/852	0/757	0/989
Improving the professional ethics of civil engineers	0/763	0/850	0/881	0/674	0/841

As can be seen, Cronbach's alpha values for all variables are above 0.7. Based on the obtained alpha coefficients, it can be concluded that the model has good internal consistency reliability. Also, the values of Dillon Goldstein's coefficients (composite reliability) show that all the values in this table are above 0.7, which shows that the model has good composite reliability. In addition, as can be seen in the results in the table, the correlation of the variables with each other, as can be seen, the AVE values placed on the diagonal of the correlation matrix are larger than the correlation

values of that variable with other variables, which indicates the validity of the model divergence.

Determining the structural model

In structural equation modeling, the part of the model that includes observable variables and model indicators is called the reflective measurement model, and the other part of the model that refers to the relationship between the hidden variables of the model is called the formative measurement model.

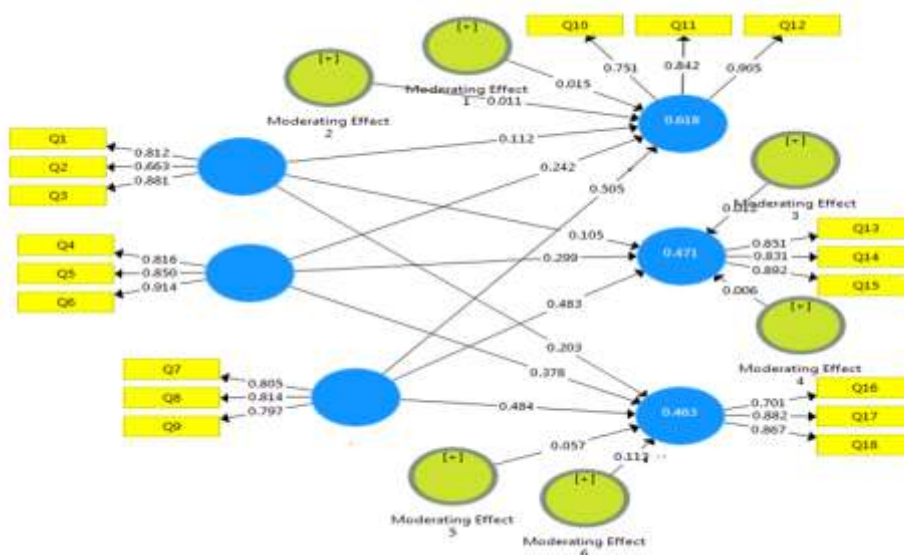


Figure 2. Research model in standard coefficient estimation mode

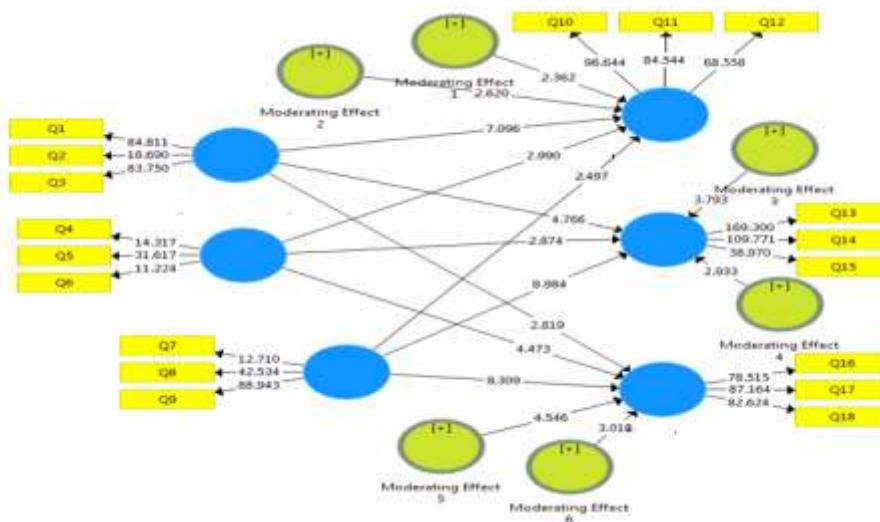


Figure 3 - Significant coefficients of the hypotheses in the model

Figure (2) (significant coefficients of hypotheses) shows the research models in the significance mode of coefficients (t-value). According to the type of hypotheses expressed in the present research, naturally, the hypotheses will be confirmed when the relevant path coefficient is positive and its significant number, which is the same as the t-statistic, is significant. According to this model, the path coefficient (Figure 3) and factor loading are significant at the 95% confidence level if the value of the t statistic is outside the range (-1.96 to +1.96) and if the value of the t statistic is within this range, As a result, the factor load or path coefficient is not significant. The coefficient of path and factor load is significant at

the 99% confidence level if the value of the t statistic is outside the range (-2.58 to +2.58). According to the results obtained from the t-test, all factor loadings have become significant at the 95% confidence level and have played a significant role in the measurement of their constructs.

Testing the quality of the measurement model or subscription index

This index is calculated by sharing index with cross validity. This index actually measures the path model's ability to predict observable variables through the values of their corresponding hidden variables. Since all the values are positive, the model has good quality

Table 5- Quality test of the measurement model or subscription index

1-sse/sso	Variables
0/261	Individual and behavioral characteristics
0/463	Values, beliefs and attitudes
0/296	Professional qualifications
0/398	General qualifications
0/455	How to evaluate and compensate services
0/363	Improving the professional ethics of civil engineers

4-2-3-3- GOF index

One of the basic differences between Lisrel and PLS is the inappropriateness of the available indicators to fit the models estimated

using PLS. The overall criterion of fit (GOF) can be obtained by calculating the geometric mean of the shared mean and R2.

$$GOF = \sqrt{\text{average}(\text{Comunalitie}) * R2}$$

Table 6- Communality test

communality	Variables
0/887	Individual and behavioral characteristics
0/902	Values, beliefs and attitudes
0/897	Professional qualifications
0/910	General qualifications
0/884	How to evaluate and compensate services
0/819	Improving the professional ethics of civil engineers

The average value of the index of shared values through the following formula is:

$$\text{Communality} = 1/N * \sum \text{Communality}$$

The subscription amount is: 0.883

The amount of R2 is also equal to 0.618. This value can be seen based on the output of path coefficients in standard mode. According to the GOF calculation formula, we have:

$$GOF = \sqrt{0/883 * 0/618} = 0/580$$

The limits of GOF index are between zero and one. Wetzles et al. (2005) introduced three values of 0.01, 0.25 and 0.35 as weak, medium and strong values for GOF, respectively. According to the value of 0.580, the research model is highly desirable.

Testing research hypotheses

Table 7 - Summary of research hypothesis results

Result	meaningful	t statistic	Standard path coefficient β	hypothesis
confirmation	Sig>0.05	7/096	0/112	Personal and behavioral characteristics have a significant effect on improving the professional ethics of civil engineers.
confirmation	Sig>0.05	4/766	0/105	Values, beliefs and attitudes have a significant effect on improving the professional ethics of civil engineers.
confirmation	Sig<0.05	2/874	0/299	Professional qualifications have a significant effect on improving the professional ethics of civil engineers.
confirmation	Sig>0.05	4/473	0/378	General qualifications have a significant effect on improving the professional ethics of civil engineers.
confirmation	Sig<0.05	2/362	+ 0/015 = 0/127 0/112	How to evaluate and compensate for services has a moderating effect on the relationship between individual and behavioral characteristics on improving the professional ethics of civil engineers.
confirmation	Sig<0.05	3/793	+ 0/012 = 0/117 /105	How to evaluate and compensate for services has a moderating effect on the relationship of values, beliefs and attitudes on improving the professional ethics of civil engineers.
confirmation	Sig<0.05	4/546	+ 0/057 = 0/260 /203	The way of evaluation and compensation of services has a moderating effect on the relationship of professional qualifications on improving the professional ethics of civil engineers.
confirmation	Sig>0.05	2/620	+ 0/011 = 0/253 0/242	The way of evaluating and compensating services has a moderating effect on the relationship of general qualifications on improving the professional ethics of civil engineers.

VI. DISCUSSION AND CONCLUSION

The expansion of societies and changes in production methods, social and psychological issues related to them have expanded and special branches of ethics called (professional ethics) have

been proposed. In today's world, professional jobs, even if they are done individually, are placed in the framework of professional organizations and with special features, including ethical regulations, which are called professional ethics. In simple

language, civil engineering is one of the branches of engineering and technical sciences that studies how and the requirements of designing, maintaining, etc. of natural and artificial structures, therefore, providing ethical models plays a very important role in the adherence of engineers to professional ethics. It is important. The present study was conducted with the aim of investigating the effective factors of improving the professional ethics of civil engineers in the construction industry in Yasouj city and the following findings were obtained:

❖ The first hypothesis: personal and behavioral characteristics of engineers have a significant effect on improving the professional ethics of civil engineers.

According to the obtained results, considering that the path coefficient and t statistic for the variables of the digital marketing hypothesis through social media have a significant effect on the perceived usefulness, it is equal to (0.112) and (7.096), respectively. And the value of t statistic is outside the range of negative 1.96 to positive 1.96, it can be acknowledged that the effect of personal and behavioral characteristics of engineers on improving their professional ethics is positive and significant.

❖ The second hypothesis: values, beliefs and attitudes have a significant effect on improving the professional ethics of civil engineers.

According to the obtained results, considering that the path coefficient and t statistic for the variables of marketing hypothesis through social media have a significant effect on the perceived ease of use, it is equal to (0.105) and (4.766), respectively. And the value of t statistic is outside the negative range of 1.96 to positive 1.96, it can be acknowledged that the impact of values, beliefs and attitudes of civil engineers on improving their professional ethics is positive and significant.

❖ The third hypothesis: professional qualifications have a significant effect on improving the professional ethics of civil engineers.

❖ According to the obtained results, considering that the path coefficient and t statistic for the variables of the electronic word-of-mouth marketing hypothesis have a significant effect on the perceived ease of use, it is equal to (0.299) and (2.874), respectively, and the value The t-statistic is outside the range of negative 1.96 to positive 1.96, it can be acknowledged that professional qualifications are positive and meaningful in improving their professional

ethics in such a way that with its increase it improves and with its decrease falls

❖ Fourth hypothesis: General qualifications have a significant effect on improving the professional ethics of civil engineers.

According to the obtained results, considering that the path coefficient and t statistic for the variables of the hypothesis of electronic word-of-mouth marketing have a significant effect on the intention to use, it is equal to (0.378) and (4.473), respectively, and the value of the t statistic, It is outside the negative range of 1.96 to positive 1.96, it can be acknowledged that the general qualifications of civil engineers have a positive and significant effect on the improvement of their professional ethics in a way that it improves with its increase and decreases with its decrease. find

❖ The fifth hypothesis: The way of evaluating and compensating services has a moderating effect on the relationship of values, beliefs and attitudes on improving the professional ethics of civil engineers.

According to the obtained results, taking into account that the path coefficient and t statistic for the variables of the hypothesis of how to evaluate and compensate for services adjusts the relationship of values, beliefs and attitudes on the improvement of professional ethics of civil engineers, respectively equal to (0.127, 0.117 and 0.260) and (2.362, 3.793 and 4.546) and the values of t statistic are outside the range of negative 1.96 to positive 1.96, it can be acknowledged that the evaluation method And compensation for services has a positive and significant effect on the relationship of values, beliefs and attitudes of civil engineers on the improvement of professional ethics in a way that improves with their increase and decreases with their decrease.

❖ Sixth hypothesis: the way of evaluating and compensating services has a moderating effect on the relationship of values, beliefs and attitudes on improving the professional ethics of civil engineers.

According to the obtained results, considering that the path coefficient and t statistic for the variables are equal to (0.253, 0.305 and 0.491) and (2.620, 2.933 and 3.018) respectively and the values The t-statistics are outside the range of negative 1.96 to positive 1.96, it can be acknowledged that the way of evaluating and compensating services on the relationship of values, beliefs and attitudes on improving the professional ethics of civil engineers adjusts in such a way that It improves with their increase and decreases with its decrease

- ❖ The seventh hypothesis: the way of evaluating and compensating services has a moderating effect on the relationship of professional qualifications on improving the professional ethics of civil engineers.

According to the coefficient of the path, it can be said that professional qualifications through the way of evaluating and compensating services on improving the professional ethics of civil engineers have a positive and meaningful moderating role, because the coefficient of the obtained path is positive. Therefore, by improving the method of evaluating and compensating services, the effect of professional qualifications on improving the professional ethics of civil engineers increases and decreases with its decrease.

- ❖ The eighth hypothesis: the way of evaluating and compensating services has a moderating effect on the relationship of general qualifications on the improvement of professional ethics of civil engineers.

According to the coefficient of the path, it can be said that public qualifications through the way of evaluating and compensating services on improving the professional ethics of civil engineers have a positive and meaningful moderating role, because the obtained coefficient of the path is positive. Therefore, by improving the way of evaluating and compensating services, the effect of public qualifications on improving the professional ethics of civil engineers increases and decreases with its decrease.

Practical suggestions

- ❖ Increasing the power and awareness of civil engineers through the development and training of efficient personnel in universities
- ❖ Delegating authority and providing scientific and practical training to civil engineering students
- ❖ Provision of appropriate trainings tailored to the needs of civil engineers by upstream organizations (engineering system).
- ❖ Creation of sufficient motivation (material and spiritual) by the engineering system organization
- ❖ Evaluation and compensation of engineers based on performance
- ❖ Comprehensive monitoring of how engineers work
- ❖ Creating an independent monitoring system to monitor the activities of civil engineers

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