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Examining Project Quality Management Processes in Contracting and Consulting Construction Companies

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ABSTRACT

According to the PMBOK standard, project quality management is implemented through three processes: quality planning, quality management, and quality control. In civil projects, quality management enhances the durability and safety of structures, thereby reducing the risk of financial and human losses during accidents. Moreover, civil projects in any country serve as prerequisites for progress and play a fundamental role in the industrialization of developing nations. Accordingly, the present study aims to investigate project quality management processes in contracting and consulting construction companies, while also highlighting the significance of quality and its management in project-based work, based on the PMBOK standard. A field research method (questionnaire technique) with a descriptive model was employed. The statistical population consisted of managers and engineers (experts) working in contracting and consulting construction companies. From this population, 203 individuals were selected as the study sample, and questionnaires were distributed among them. Data were analyzed using the Kolmogorov-Smirnov test and the one-sample *t*-test. The findings indicate that in construction companies, quality planning receives more attention compared to the other two processes quality management and quality control which requires corrective measures.

1. INTRODUCTION

In the past, quality was considered an additional advantage to products; however, today, quality is an inseparable component of every product, and only superior quality provides the license to compete in highly competitive markets [1]. The significance and position of quality orientation, which has now become the dominant perspective in organizations and societies, has introduced quality management as a necessity for ensuring organizational survival in intensely competitive conditions [2]. In project-based activities, quality management principles are integrated with project management techniques [3].

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Although project management has been informally practiced for centuries, it was only in the mid-twentieth century that it became recognized as a distinct profession. In this regard, the Project Management Institute (PMI) was established in the United States in the late 1960s as a non-governmental, non-profit institution with the goal of consolidating the field of project management. PMI published a guideline entitled A Guide to the Project Management Body of Knowledge (PMBOK). The PMBOK aims to identify the multiple components of project management processes. It incorporates both traditional, proven practices and innovative approaches widely acknowledged for their value and impact in the field. The first edition of this guide was published in 1996 and has since been revised periodically. The recommended methods of this standard are categorized into ten knowledge areas:

- Project Integration Management
- Project Scope Management
- Project Schedule Management
- Project Cost Management
- Project Quality Management
- Project Resource Management
- Project Communication Management
- Project Risk Management
- Project Procurement Management
- Project Stakeholder Management

According to this standard, project quality management one of the ten knowledge areas is defined as:

"Project quality management includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements to meet stakeholders' objectives. It also supports continuous process improvement activities carried out on behalf of the organization."

Based on this standard, project quality management encompasses three processes:

- **Quality Planning**: Identifying the quality requirements or standards for the project and deliverables, and documenting how the project will demonstrate compliance.

- **Quality Management**: Converting the quality management plan into executable quality activities that incorporate the organization's quality policies into the project.

- **Quality Control**: Monitoring and recording results of quality management activities to evaluate performance and ensure project outputs are complete, accurate, and meet customer expectations [3].

Enhancing quality in projects directly and indirectly contributes to organizational growth and sustainability, as well as customer (employer) satisfaction and the fulfillment of other stakeholders' interests. In recent years, quality in construction projects has gained more importance due to the significant financial allocations involved, social and economic sensitivities, and their strategic role. Despite specialized regulations and guidelines, many projects still fail to meet deadlines, stay within budget, and achieve quality standards that match expectations [4]. To ensure high-quality projects, quality management processes must be applied throughout the entire project lifecycle (e.g., review, design, construction organization, and maintenance). Among these, the construction phase is the most complex, as it accounts for the highest portion of project costs (70–80%) and involves the most challenging quality control and management efforts [5].

In today's highly competitive economic environment, improving quality management has always been regarded as a critical issue for construction companies [5]. Project management consultants, due to their assumed superiority in knowledge and experience, bear ultimate responsibility for ensuring proper project execution. Therefore, quality management in consultancy organizations must focus on the key success factors [6].

Time, cost, and quality are considered the primary objectives of any project. In recent years, stakeholders' demands for reducing overall project costs while simultaneously shortening timeframes and improving quality have intensified. This has led researchers to develop models that integrate quality into earlier cost–time trade-off models [7]. Quality Management Systems (QMS) play a vital role in ensuring project quality and reducing costs [8]. These systems, at every stage of project processes, prevent expenses associated with rework, repairs, and corrections, thereby guaranteeing quality for the client (employer) [4]. Additionally, they help contractors save on materials, labor, and equipment, while also enhancing their reputation in the market [9].

Overall, the PMBOK standard identifies five levels of quality management, considering costs and implications:

1. The most expensive approach is when the customer detects defects, which may lead to warranty issues, recalls, loss of reputation, and rework costs.

2. Identifying and correcting defects before delivering products to the customer, as part of quality control, which involves appraisal and internal failure costs.

3. Applying quality assurance to review and improve processes, not merely specific defects.

4. Incorporating quality into project and product planning and design.

5. Establishing an organizational culture that is both aware of and committed to quality in processes and products [3].

Numerous researchers have examined quality management and its role in organizations and projects. For instance, Yahyapour and Haravi (2014) classified the factors influencing building construction quality in Iran and concluded that quality management can significantly reduce additional costs resulting from poor quality. They emphasized that to achieve desired quality and minimize failure and rework costs, preventive and appraisal costs are unavoidable [10]. Gerami and Hosseini (2014) highlighted poor material quality, weak performance of stakeholders, and deficiencies in responsible organizations as the most critical factors affecting construction quality [11].

Feng, Zhang, and Ishii (2013), in their study on fuzzy multi-criteria decision-making approaches for assessing project quality management, identified quality planning dimensions as the most influential aspect of project quality management [12]. Akikura et al. (2017), through evaluating construction participants' attitudes toward quality management, found that poor-quality projects reduce opportunities for construction firms to secure new contracts [13]. Sheikh et al. (2019) investigated key factors influencing process quality in Pakistani construction projects and identified contractor selection as the most significant factor [14]. Similarly, Watson (2008), in his work on extending project quality management, concluded that quality improvement management is essential for sustained success and that quality management (QM) remains a business necessity that will continue to be a core part of organizations' functions [15]. Captorino et al. (2017), in examining quality management in project management consultancy firms, highlighted leadership style and communication skills as being more critical to project success than technical aspects [6].

2. RESEARCH METHOD

This study is applied in terms of purpose, descriptive-survey in terms of methodology, and quantitative in nature. The statistical population consisted of experts from civil engineering contracting-consulting firms in Sanandaj city, totaling 430 individuals. Given the known population size, Cochran's formula was used to determine the sample, resulting in 203 participants selected for the survey.

The instrument used was the standardized questionnaire developed by Soltanpanah et al. (2014), consisting of 13 items: 4 items on quality planning, 4 on quality assurance, and 5 on quality control. An additional section was designed to collect demographic information from respondents. A five-point Likert scale was applied to all questions, ranging from very high (5), high (4), moderate (3), low (2), to very low (1).

To assess validity, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed. The results showed that all factor loadings exceeded 0.30, and all significance levels were greater than 1.96, indicating that the questionnaire possessed acceptable validity.

To test reliability, the questionnaire was distributed among 30 employees of consulting-construction firms in Sanandaj. Using Cronbach's alpha, reliability was confirmed, and the obtained alpha values demonstrated acceptable internal consistency.

Table 1. Cronbach's Alpha Reliability Coefficients

Variable	Dimension	Reliability
Project Quality Management	Quality Planning	0.813
	Quality Management	0.834
	Quality Control	0.710
Overall Reliability (13 items of Project Quality Management)		0.812

To test the normality of the research data, the Kolmogorov–Smirnov test was employed. The significance level was obtained as 0.054, which is greater than 0.05, thereby confirming the normal distribution of the data.

The response procedure was consistent for all participants. After obtaining consent from the contracting–consulting company and providing the necessary instructions for completing the questionnaires, the survey forms were distributed to managers and engineers. No time limit was imposed for completion.

Upon collecting the completed questionnaires, both descriptive and inferential statistics were applied to analyze the data, given the normal distribution. Using SPSS software, descriptive statistics such as mean and standard deviation were employed, while inferential analysis included the one-sample t-test and significance levels.

Table 2. Descriptive Indicators of Project Quality Management Variable

Dimension	Item	N	Mean	Std. Deviation	Std. Error Mean
Quality Planning	q1	203	3.66	1.024	0.072
	q2	203	3.83	1.019	0.072
	q3	203	3.65	1.099	0.077
	q4	203	3.92	1.052	0.074
Quality Management	q5	203	3.49	1.029	0.072
	q6	203	3.38	1.100	0.077
	q7	203	3.45	1.071	0.078
	q8	203	3.39	1.054	0.082
Quality Control	q9	203	3.36	1.042	0.074
	q10	203	3.33	1.084	0.083
	q11	203	2.79	1.114	0.084
	q12	203	3.13	1.102	0.085
	q13	203	3.34	1.090	0.077

Based on the mean scores of the different dimensions of project quality management (Table 2), it is evident that the quality planning process achieved the highest score with a mean of 3.765, followed by quality management with a mean of 3.427, while quality control received the lowest score with a mean of 3.19.

These findings highlight that the construction companies under study place greater emphasis on compliance with construction requirements and standards prior to project initiation, while relatively less attention is paid to the execution phase in accordance with quality frameworks and to on-site quality control. This lack of emphasis may increase the likelihood of rework and corrective costs during project implementation.

Table 3. One-Sample t-Test

Dimensions of Questions	Questions	Test Value = 3.5	t-statistic	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
Quality Planning	q1	2.159	202	0.000	0.165	0.01	0.30
	q2	0.999	202	0.002	0.331	-0.21	0.07
	q3	1.947	202	0.000	0.150	0.00	0.30
	q4	5.637	202	0.000	0.422	0.27	0.56
Quality Management	q5	-2.899	202	0.062	-0.012	-0.35	-0.07
	q6	3.669	202	0.083	-0.123	-0.13	0.44
	q7	3.198	202	0.078	-0.052	-0.10	0.40
	q8	2.792	202	0.116	-0.112	-0.07	0.39
Quality Control	q9	-8.263	202	0.052	-0.143	-0.82	-0.50
	q10	1.516	202	0.131	-0.176	-0.04	0.29
	q11	3.203	202	0.202	-0.715	-0.10	0.43
	q12	2.302	202	0.072	-0.373	-0.03	0.36
	q13	0.740	202	0.460	-0.161	-0.09	0.21

As shown in Table 3, since the significance level (p-value) of quality planning processes is less than 0.05, the null hypothesis (H0: $\rho = 0$) is rejected. In other words, the importance of quality planning processes in contracting and consulting engineering firms is evaluated as high to very high.

However, since the significance level for quality management and quality control processes is greater than 0.05, the alternative hypothesis (H1: $\rho \neq 0$) is rejected. This indicates that the importance of these two processes in engineering firms is below the average level, i.e., low to moderate.

3. CONCLUSION

In this study, the status of project quality management processes in consulting and contracting firms in the construction sector was examined based on the PMBOK standard. The results indicate that greater emphasis is placed on quality planning processes compared to other processes. In other words, identifying quality requirements and standards for construction projects, and documenting the procedures for their implementation, are prioritized over the actual implementation of standards, ensuring their correct execution during the project, and verifying that project outputs meet customer needs.

This trend is not fully aligned with the principles of project quality management, since continuous improvement and maintaining quality from the beginning to the end of a project are among the most critical elements of effective quality management. Achieving timely completion, within budget, and with the desired level of quality are recognized criteria for the success of construction projects, all of which require adherence to every stage of project quality management. According to PMBOK, the three main stages and processes are interconnected. These interrelationships are not confined to the boundaries of project management constraints; rather, they interact much like processes in various scientific disciplines, with each process implemented to address one or multiple project needs.

Furthermore, considering the different levels of quality management costs highlighted in this study, neglecting quality assurance and quality control processes results in higher appraisal and non-conformance costs during implementation and after project delivery, ultimately burdening executing firms. Focusing only on quality planning without effective management and control leads to increased expenses in inspection, supervision, and rework.

It should also be noted that a significant portion of the country's national income is invested annually in construction projects, most of which are carried out by consulting and contracting firms. Therefore, addressing this issue not only helps project managers and stakeholders identify weaknesses and allocate resources more effectively, but also ensures that corrective actions can be taken where deficiencies exist. Such improvements will enhance the quality and safety of construction projects, offering a valuable avenue for future research.

Transparency Statement

The data supporting this study are available upon reasonable request to the corresponding author, subject to ethical and confidentiality considerations.

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Declaration of Interest

The authors declare that they have no competing interests.

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