

The Influence of ISO 9001:2015 on Quality Management Practices in Construction Projects

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ABSTRACT

The construction requires good quality management in order to deliver project results that meet customer needs and meet the requirements already planned. The implementations of such ISO 9001:2015 will contribute to improve the quality of product which produced by the company. This study aims to determine the significance effect on the variable measure from the ISO 9001:2015 clausal on project construction management. The survey was conducted in four construction projects. The independent variables used in this study consisted of seven indicators, which are organization management (X4), Leadership (X5), Planning (X6), Support (X7), Operation (X8), Performance evaluation (X9), and Improvement (X10). The dependent variable is the quality of the project outcome (Y). The quality improvement correlation and the significance will tested by using multiple regression linear. The results from the analysis are the overall Mean Score, the quality score is 3.843, which is the highest score from the questionnaire spread among 35 respondent. Furthermore, the F test obtained 12,419, higher than shown in F table 2,39, which shown that the implementation of ISO 9001: 2015 simultaneously affected to the quality improvement on the construction project. The conclusion from the analysis was shown on the formulation: $Y = -0.503 + 0.470X4 - 0.061X5 + 0.075X6 - 0.190X7 + 0.388X8 + 0.597X9 - 0.130X10$. There are three clauses that affected to the quality significantly, ie: performance evaluation with score 0.597, organizational context 0.470, and operational 0.388. Meanwhile for the leadership, planning, support, and improvement, statistically have not affected significantly, as the p-value obtained is higher than 0.05. Furthermore, its need to ensure that all indicators should be well organized by the contractor in progress to reach quality improvement, review operational control, and evaluate progress, method, and final check for all projects, simultaneously.

KEYWORDS: ISO 9001, significance, Quality Improvement, Performance Evaluation

AMS Subject Classification:

1. Introduction

Construction industry was growing rapidly in this century for last decade. Growth on infrastructure ie, housing, offices, and other facilities is very easy to find in various regions. The magnitude of opportunity in this sector was generated to the construction service industry play in competitive ways and influenced them in getting new projects, and also in fulfillment company benefit increasingly.

Meanwhile, the customers of construction service providers will be requiring high quality construction services, low prices, and rapid development process. These conditions was forced the construction industry to improve the quality level of construction in order to meet the expectations of their customers.

Furthermore, number of factors might be affected by the quality of project outcomes, ie: design, manpower, raw materials, equipment, quality systems, field staff, project owners, and contractors Ahmed & Yusuff (2016)[1]. Supporting those statement, others researcher reveal the seven biggest factors affecting project quality are resources, communication, labor, materials, inspection, standards, and quality system Shobana & Ambika (2016)[2]. The best practice of quality management system is known as Total Quality Management (TQM). Total Quality Management believed as the key to continuously improve performance at every level of operation and processes in an organization, by effectively use all available human and capital resources. Improvements to these processes are intended to make the planning, construction and handover process reliable. TQM has proven to be a useful tool in ensuring the achievement and setting of standards and quality improvement in the construction industry, successfully Bakar et.al. (2011)[3]

Implementation of TQM in guidance of construction projects can be initiated by applying of ISO 9001 standards. Even though, ISO 9001 is not a TQM standard, but ISO 9001 can be a clearly guide to implementing TQM as the forth steps have been set in the form of quality guidelines Sallis (2014)[4]. Furthermore, this certainly allows companies in implementing them.

ISO 9001:2015

Earlier, ISO 9001 is a very helpful international standard as a perfect method of TQM implementation. As the definition of ISO 9001, which is encourage the company together with all stakeholders to start a process of continuous improvement Fonseca (2015)[5]. ISO 9001 has clearly stated to set up a standard publications (and reviewed every 5 years), even sometimes its confirmed that the situation stay at the same and nothing has changed. To anticipate the different of Management System Standards, key elements have been set up under the Plan-Do-Check-Act (PDCA) principles (Clauses 6, 8, 9, and 10):

- Clause 4 = The organization's business environment and QMS coverage
- Clause 5 = Leadership and organizational structure.
- Clause 6 = (plan) Planning.
- Clause 7 = Supporting process and capability.
- Clause 8 = (do) Operational process.
- Clause 9 = (check) Performance evaluation.
- Clause 10 = (action) Improvement

ISO 9001: 2015 has underlined number of changes compared to ISO 9001: 2008. There are two main objectives in these change. ISO 9001-2015 emphasized on risk management to do prevention on measurement of planning, operations, analysis and evaluation activities and facilitate collaboration with other relevant ISO standards, such as ISO 14001: 2015, ISO 55001 and ISO 45001.

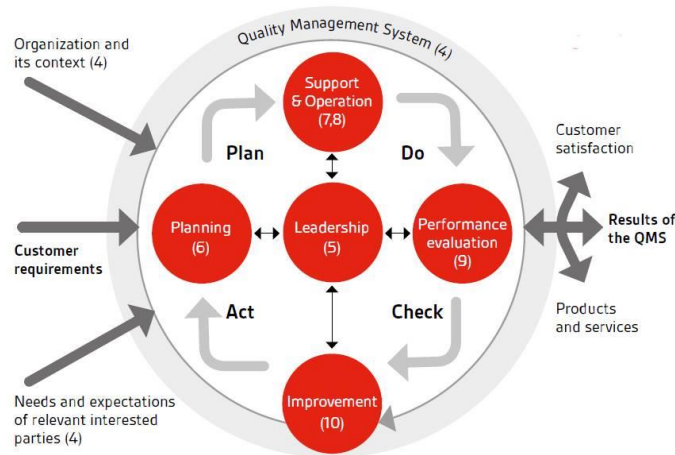


Figure 1: Representation of ISO 9001: 2015 structure in PDCA cycle (ISO 9001 2015)[6]

The changed on ISO 9001:2015 adopted by the organization are as follows:

1. There are two main Clauses added in ISO 9001:2015 (from eight to ten clauses) as the different from ISO 9001:2008. They are ensuring the structured and properly grouped to facilitate collaboration with other relevant ISO standards, such as ISO 14001: 2015, ISO 55001, and ISO 45001.
2. The quality management principle of ISO 9001 is reduced from eight principles in ISO 9001: 2008 to seven principles in ISO 9001: 2015 by collaborated the approach of system and process.
3. The quality manual shall not be a fulfillment special requirement, even though, it still applied. New requirements for "documented information" give discretion on how to applied.
4. Management representatives as the officially appointed, that will be no longer required in ISO 9001: 2015. As in the implementation of ISO 9001, which is expected to not only rely on a person in charge. Instead, management is required to appoint someone with a management representative role from part / division / department who have same duties and responsibilities, so the situation looks very similar in the implementation of quality management system in ISO 9001: 2008
5. None of the ISO 9001: 2015 clauses explicitly explains the permissibility of excluding one of ISO 9001: 2015 clauses. While in ISO 9001: 2008 still allow the exclusion of one of clause or sub-clause 7 if there are irrelevant rules.
6. In term of replace the preventive action into risk management, which are to establish a systematic approach as consider to risk, rather than treating "prevention" as a separate part in the quality management system (ISO 9001 2008)[7]. Risk management is containing all aspects of quality management system. The risks

closed to all management systems, processes and functions. Risk-based on thinking, which are ensures in identification, monitoring and controlling throughout the quality management system design and useability. ISO 9001 has also been used as a quality standard for construction under Indonesian Decree by Ministry of Settlement and Regional Infrastructure No. 362 / KPTS / M / 2004 Year 2004, as an approach to improve the quality of construction projects and meet the customer requirement.

Methodology

A number of inputs affected the construction process as the activity factors, which categorized as independent variables on this research. The independent variables are formulated through literature review and deep interviews with three construction practitioners who have more than 15 years of experience, and one ISO 9001 expert in the company. The circumstances that can provide impact to the construction process, then grouped into the clause in ISO 9001: 2015. Also, it is used to see the level of compliance with ISO 9001 implementation and it used to identify problems arising from the implementation of ISO 9001 (Anup et.al. (2015)[8].

Questionnaires were sent to 35 respondents (total populations), they are foreman, supervisors, and project managers. Furthermore, the steps are analyzed by using Overall Means Score, multiple linear regression, including F test to determine whether the regression coefficient of independent variable have significant influence (or not) on the dependent variable and t test to test whether each regression coefficient independent variables have influence (or not) to the dependent variable.

Research Results and Discussion

From mean score, it was found that Y (quality) score is the highest on 3.843 score. So that, it can be concluded that the dependent variables (X1 through X5) have positive impact and assess the quality of construction work in most satisfactory way. As a reference, ISO 9001 certified construction companies get 2.95 on a scale of 0-4 (Willar et.al. (2015) [9] or if converted to a scale of 0-5 to 3.687.

Table 1. The mean value of the independent and dependent variable

Pos.	Var.	Clause	Mean
7	X4	Context of the organization	3.621
4	X5	Leadership	3.821
2	X6	Planning	3.636
5	X7	Support	3.771
7	X8	Operation	3.621
2	X9	Performance evaluation	3.836
6	X10	Improvement	3.623
1	Y	quality	3.843

As found that all variables are in normal distribution, then, Pearson correlation is applied to evaluate the relationships in between variables. The correlation helps to simplify how variables are related in strength and direction. Pearson correlation coefficient (r) is used to find the normal distribution and the linearity in this study.

Although, Pearson Correlation Test is used to examine the relationship between independent variables ie organizational context, leadership, planning, support, operational, performance evaluation, and improvement with the dependent variable (quality in construction project during construction). Table 2 shows that the dependent variables have significant and positive impact to all of the importance factors. Furthermore, the highest correlation in the dependent variable is the performance evaluation followed by the operational, and the organizational context.

As shown on Table 2, bellows are the:

Table 2. Rank Spearman's correlation between independent and dependent variable

	Quality
Context of the organization	.628**
Leadership	.578**
Planning	.590**
Support	.633**
Operation	.784**
Performance evaluation	.800**
Improvement	.626**

Multiple linear regressions' was used to test how significant the quality in a construction project during construction can be affected by all of independent variables. The statistical method used to estimate the effect of several independent variables is multiple linear regression analysis that illustrates how the dependent variable of the research framework will be affected by some predictors (independent variables). The design of multiple linear regression models are the organizational context, leadership, planning, support, operations, performance evaluation. The quality improvement are determined as independent variables and the quality in construction projects during construction is considered as a dependent variable. The general form of multiple regression equations is presented as follows where β_0 is the term intercept and β_1 to β_7 is the multiple regression coefficient of the predictor for quality in the construction project.

$$\text{Quality} = \beta_0 + \beta_4 (\text{Context of the organization}) + \beta_5 (\text{Leadership}) + \beta_6 (\text{Planning}) + \beta_7 (\text{Support n}) + \beta_8 (\text{Operation}) + \beta_9 (\text{Performance evaluation}) + \beta_{10} (\text{Improvement})$$

The coefficient of determination (R^2) is used in statistical analysis to estimate how significance the regression model and prediction of the outcome. And also, this is indicated the level of variability described in the model. Based on multiple regression results, it was observed that the coefficient of determination for this model is 0.763. Meaning, 76.3% of quality variation in construction project might be explained by organizational context, leadership, planning, support, operational, performance evaluation, and improvement.

Table 3. Result Testing Value of R and R^2
Model Summary^b

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.874 ^a	.763	.702	.31087

a. Predictors: (Constant), organizational context, leadership, planning, support, operational, performance evaluation, and improvement.

b. Dependent Variable: Quality

The adjusted of R^2 (70.2%) is higher than 50%, so that, the equation can be used to predict the quality in the construction project.

Table 4. F Test result

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.401	7	1.200	12.419	.000 ^a
	Residual	2.609	27	.097		
	Total	11.011	34			

a. Predictors: (Constant), organizational context, leadership, planning, support, operational, performance evaluation, and improvement.

b. Dependent Variable: Quality

The results of the F test for multiple regression analysis shown that, the P value (sig.) is less than 0.05 which means there is enough evidence to conclude that at least one of the independent variables will be a significant predictor of quality in the construction project.

Partially, organizational context clause, operational and performance evaluation have significance effect to quality as shown in value is less than alpha 0.05. The value of $\beta_4 = 0.470$ in the organizational context clause, the value of $\beta_8 = 0.388$ in the operational clause and the value of $\beta_9 = 0.597$ on the performance evaluation states that it can significantly improve the quality of the project result, since the value of the coefficient is positive. Meanwhile leadership clauses; planning, support, and improvement have a significance value higher than alpha value 0.05. Finally, it could be conclude that statistically have significance affect to quality.

Table 5. t Test result

Coefficients^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.503	0.557		-0.903	0.375
Context of the organization	0.470	0.200	0.330	2.350	0.026
Leadership	-0.061	0.187	-0.065	-0.325	0.748
Planning	0.075	0.187	0.078	0.403	0.690
1 Support	-0.190	0.206	-0.177	-0.922	0.365
Operation	0.388	0.168	0.362	2.313	0.029
Performance evaluation	0.597	0.223	0.532	2.673	0.013
Improvement	-0.130	0.281	-0.079	-0.464	0.646

a. Dependent Variable: Quality

Conclusion

Quality is a very important factor in meet the customer needs and satisfied the project owner. The costs incurred on the implementation of a construction project required that each factor of this industry need to ensure the quality of the construction project. So that, construction project will survive continuously, and also gain with confidence to run other construction projects.

The results of the study identified the key factors affected to the quality, during construction projects. This objective has been achieved by measuring responses using SPSS software to analyze data collected through descriptive analysis and correlation analysis. The questionnaire was used as an instrument in this study to collect the necessary data and designed on a five-point Likert scale.

Based on the data analysis on factors which affected to the quality of construction projects, it was found that the importance of all factors have significance influence to the quality. The results of the study indicated that there are three factors: performance evaluation, organizational context, and operations that show significant influence on quality in construction projects. Thus, multiple regression analysis indicate that the highest effect to quality, comes from performance evaluation. This factor is indicated by project manager, supervisor, and project owner to achieve good quality on construction project. Therefore, it need to ensure that, these three variables should be well executed by the contractor, applied quality management system, control all operational process, evaluate progress and method, and also do final check for all finished projects.

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