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Relationship Between Leadership and Commitment with Quality Performance on U-Th-REE Processing Pilot Plant Construction in BATAN

Hubungan Antara Kepemimpinan dan Komitmen dengan Kinerja Mutu pada Konstruksi Pilot Plant Pengolahan U-Th-LTJ di BATAN

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ABSTRACT

Management area of leadership and commitment in the quality management system is a mean to achieve successful functions, even more on construction industry. The objective of this research is to analyze the correlation between leadership and commitment focus management area and quality performance as indicated by rework. Research location is uranium (U), thorium (Th), and rare earth elements (REE) processing pilot plant construction area in Center for Nuclear Minerals Technology-BATAN. Primary data were collected from the 36 of 37 submitted questionnaires, and representing 97 % response rate. The research used descriptive analysis, which depends on the poll and the use of Statistical Package for the Social Sciences (SPSS) main program for data analysis. The relationship between leadership and commitment and quality performance was analyzed using spearman rank correlation coefficient. Findings of research provide guideline and alert to project managers or management of organization where leadership, commitment, infrastructure, and environmental work have moderate to strong correlation to rework level. The results further revealed that there is no relationship between responsibility and authority for the management system and organizational policy and construction quality performance. The research provides evidence, in fact to achieve the quality performance of a pilot plant construction must be concerned with leadership attribute, maintaining commitment and provide support resources on the whole project cycle.

Keywords: leadership, commitment, quality performance, construction, U-Th-REE pilot plant

ABSTRAK

Area manajemen kepemimpinan dan komitmen dalam sistem manajemen mutu adalah sarana untuk mencapai keberhasilan suatu pekerjaan, terlebih pada industri konstruksi. Tujuan dari penelitian ini adalah untuk menganalisis hubungan antara area fokus manajemen kepemimpinan, komitmen, dan kinerja kualitas yang ditunjukkan dengan pengerjaan ulang (*rework*). Lokasi penelitian adalah area kontruksi *pilot plant* pengolahan uranium (U), torium (Th), dan unsur logam tanah jarang (LTJ) di Pusat Teknologi Bahan Galian Nuklir-BATAN. Data primer merupakan hasil 36 dari 37 kuisioner yang dikirimkan, dan mewakili tingkat respons 97 %. Penelitian ini menggunakan analisis deskriptif, yang bergantung pada polling dan menggunakan program utama Paket Statistik untuk Ilmu Pengetahuan Sosial (SPSS) untuk analisis data. Hubungan antara kepemimpinan dan komitmen dan kinerja kualitas dianalisis dengan menggunakan koefisien korelasi pemeringkatan *spearman*. Hasil penelitian memberikan panduan dan peringatan kepada manajer proyek atau manajemen organisasi bahwa kepemimpinan, komitmen, dan infrastruktur serta lingkungan kerja memiliki korelasi menengah hingga sangat kuat terhadap tingkat pengerjaan ulang. Hasil lainnya mengungkapkan bahwa tidak ada hubungan antara tanggung

jawab dan wewenang sistem manajemen serta kebijakan organisasi dengan kinerja kualitas konstruksi. Penelitian ini memberikan bukti bahwa sebenarnya untuk mencapai kinerja kualitas konstruksi *pilot plant* harus memperhatikan atribut kepemimpinan, mempertahankan komitmen, dan memberikan sumber daya pendukung pada keseluruhan siklus proyek.

Kata kunci: kepemimpinan, komitmen, kinerja kualitas, konstruksi, pilot plant.

INTRODUCTION

The technology of processing of nuclear excavation materials such as the separation of uranium (U), thorium (Th) and rare earth metal elements (REE) has been developed by BATAN. The construction phase play a very important role. Construction of a nuclear facility like pilot plan requires expertise on its implementation to prevent contamination [1]. A nuclear facility, although on a pilot scale, should accommodate project excellence, which is an element of adequate safety. This will be greatly affected by the quality of the project, in terms of design and construction work [2]. Quality, in its simplest form, can be defined as: 'meeting the customer's expectations,' or 'compliance with customer's specification [3]. In the literature review, it is found that the primary indicators of construction quality are percent cost of rework and rate of construction defects [4]. On the basis of a comprehensive literature review, the reported several measures of rework are errors, omissions, failures, damage, and change orders throughout the procurement process [5]. Therefore, management system is needed to maintain the quality of construction in accordance with the requirements. The implementation of a quality management system is the first step in building a quality-oriented environment and achieving Total Quality Management (TQM) within the organization [6]. Since, the quality management system will affect the quality of a project that led to the superiority and reliability of the project [2]

Nuclear-related organizations, both products and services, must meet some safety requirements, including those in the IAEA safety standards. Therefore, in addition of using ISO 9001:2015 as a quality management system, this pilot plant construction used a management system for facilities and activity IAEA safety standard no. GS-R-3 as reference. One of the focus areas of management in both standards are leadership and commitment. Combining focus areas on both standards, there are several factors as indicators: leadership, management commitment, responsibility and authority of management system, organization policy, and infrastructure and work environment. Some research on leadership has been done, like how to create a strategic leadership to a given situation [7], leadership behavior [8], leadership style [9] and relation between leadership and successful project [10].

It is necessary to understand leadership practices for project success, because leadership is even more vital in the construction industry where success is measured by the projects being on time and within budget [10]. Criteria of project success, one of which, is performance in terms of time, cost, quality (TQ) [11]. Since construction project are large and technically complex and they involve a combination of specialized skills, this does not mean that the project leader should or could do everything associated with the project; but it does mean that they have ultimate responsibility for the

project [10]. Therefore leaders in construction project should motivate and inspire construction workers within the given projects [10], and should considered to be good if it is designed to accomplish the goal or mission of an organization which is done through project team leading and project time managing, within budget, to a high quality, and with a satisfied customer [12].

The body of literature provides support for a relationship between leadership and project success. However previous studies have not specified the criteria of a successful project [11]. This paper address this gap by correlation analysis between the combined indicators in the focus area of leadership management and commitment and project quality performance i.e. the level of rework, case study on separation of U-Th-REE Pilot Plant Construction at Center for Nuclear Minerals Technology-BATAN.

METHODOLOGY

This research use questionnaires as a form of quantitative approach that describes and test relationships and examines causes among variables [13]. In addition, this research use a descriptive design, includes surveys and fact-finding enquiries at different kind. The methods of utilized descriptive research are survey method of all kinds including comparative and correlation method [14]. The study case conducted careful and completed observation and analysis of a unit in its relationship to any other unit [15]. This research uses primary and secondary data sources. The primary data obtained through the questionnaire on targeted respondents. Respondents are those involved in the construction work of the pilot plan. They are the owner of pilot plant, contractor and supervisor with more than two (2) years experiences. The secondary data derived from literatures review. Primary data were collected from the 36 of 37 submitted questionnaires representing a 97 % response rate. This indicates that the analyzed data were not bias, because the rate of return is more than 30-40 % [16]. Also, any research based on measurement of variables must be concerned with the accuracy and dependability [10]. Secondary data used to build the independents variables of questionnaire, namely the focus area indicator of management leadership and commitment ISO 9001:2015 and IAEA GS-R3. The dependent variables, quality performance as indicated by rework [5,11].

The research used descriptive analysis, which depends on the poll and use the Statistical Package for the Social Sciences (SPSS) main program for data analysis. The relationship between focus area management leadership, commitment and quality performance was analyzed using spearman rank correlation coefficient. Spearman rank correlation is appropriate when one or both variables are skewed or ordinal [17]. Correlation analysis measures the relationship between two things, for example, a leadership indicator and rework. The correlation coefficient (resulting value) was utilized in this research to measure the relationship amongst the research variables (leadership indicators and quality performance) as seen on Table 1. The statistical analysis produces statistical significance testing (p-value) which is as important as the coefficient correlation value. Statistical significance testing, the P value or calculated probability, is the probability of finding the observed or more extreme, results when the null hypothesis (H_0) of a study question is true [18]. Researchers often “reject the null hypothesis”

when the p-value turns out to be less than a predetermined significance level, often between 0.05 or 0.01 [10]. This research uses the p-value at 0.05 as used in previous studies [4,10,19]. Subsequently, the correlation coefficient (r-value) numerical value ranges from +1.0 to -1.0. In general, r > 0 indicates a positive relationship while r < 0 indicates a negative relationship and r = 0 indicates no relationship (or that the variables are independent of each other and not related) [20]. A coefficient of +1.0 means that the two variables have a perfect positive relationship, when one variable moves higher or lower the other variables move in the same direction with the same magnitude. When a coefficient turns -1.0, the relationship is said to be perfectly negative correlated, in short, if one variable increase, the others decreases with the same magnitude, and vice versa [21]. The rule of tomb for interpreting size of correlation coefficient show on Table 2 [17].

Table 1. Independents variable in research.

Factors	Code
Leadership	X_1
Commitment	X_2
Responsibility and Authority for the management system	X_3
Organizational policy	X_4
Infrastructure and environment work	X_5

Table 2. The interpretation of correlation size for the research.

Size of Correlation	Interpretation
0.90 to 1.00 (-0.09 to -1.00)	Very high positive (negative) correlation
0.70 to 0.90 (-0.70 to -0.90)	High positive (negative) correlation
0.50 to 0.70 (-0.50 to -0.70)	Moderate positive (negative) correlation
0.30 to 0.50 (-0.30 to -0.50)	Low positive (negative) correlation
0 to 0.30 (0 to -0.30)	Negligible correlation

The hypothesis development in this research was built upon focus management area leadership and commitment quality management system between ISO 9001:2015 and IAEA GS-R as independent variables in Table 1. The dependent variable is quality performance indicated by rework. Construction Industry Institute has develop a simple formula to count the impact on rework in the construction cost as follows [22]:

$$\underset{(TFRF)}{Total\ Field\ Rework\ Factor} = \frac{Total\ Direct\ Cost\ of\ Field\ Rework}{Total\ Construction\ Cost}$$

The rework scale and criteria at Separation of Uranium, Thorium and Rare Earth Metals Pilot Plant Construction as seen in Table 3 [23]. Accordingly those data the following hypothesis of this research has developed:

H_o: There is no correlation between leadership and commitment with rework as quality performance.

H_1: There is correlation between leadership and commitment with rework as quality performance.

Table 3. Scale and criteria of rework.

Scale	Description (%)	Criteria
1	≥ 2.0	Very high
2	$1.5 \leq$ to ≤ 2.0	High
3	$1.0 \leq$ to ≤ 1.5	Moderate
4	$0.5 \leq$ to ≤ 1.0	Low
5	< 0.5	Very Low

RESULTS AND DISCUSSION

The 36 respondents in this study have the requisite work experience of at least two (2) years and the personnel of the owner, contractor and supervisor. Therefore, the positions and work experience of the respondents are varying. The tabulation of position data and work experience of respondent can be seen in Figures 1 and 2. Respondents fill out the questionnaire

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according to their experience on influence the leadership and commitment to rework level in construction project.

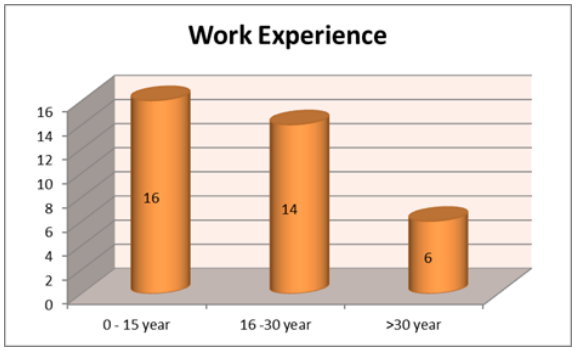

Figure 1. Respondents data tabulation related with working experiences.

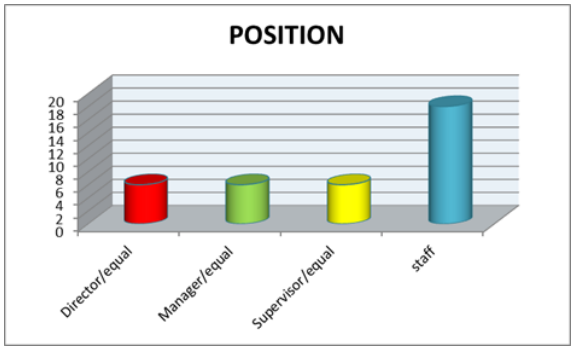

Figure 2. Respondents data tabulation related with job position.

The questionnaire is intended to derive factors from the leadership and commitment areas at Table 2 that have an influence on the quality performance of the pilot plant construction. The scale of this questionnaire using ordinal scale from 1 to 5. Scale 1 indicates that the factor does not give any influence, continue to be tiered to scale 5, which means that the factor is very influential to the quality performance of pilot plant construction.

Respondents answer to Leadership (X_1) and Commitment (X_2) factors on scale 5 for maximum and scale 4 for minimum values, while Responsibility and Authority for the management system (X_3), Organizational policy (X_4), and Infrastructure and environmental work (X_5) on a scale of 5 for a maximum value and a scale of 3 for the minimum value. The data summary of the questionnaire results can be seen in Table 4.

Table 4. Summary of respondent questionnaires

Variable	N	Minimum	Maximum	Modus
X_1	36	4.00	5.00	4.00
X_2	36	4.00	5.00	5.00
X_3	36	3.00	5.00	5.00
X_4	36	3.00	5.00	5.00
X_5	36	3.00	5.00	4.00

In the correlation analysis, strength and direction of the relationship will be valued if the relationship between these variables were significant. The significance level of the influence of X variables can be seen from the value of Sig. (2-tailed) from the calculation using SPSS program with the following criteria:

- If the value of Sig. (2-tailed) calculation results <0.05, then the relationship between these two variables is significant.
- If the value of Sig. (2-tailed) calculation results >0.05, then the relationship between these two variables is not significant.

Based on the spearman rank correlation analysis shows results as follows:

1) Leadership (X_1) variable correlation with rework construction of pilot plant is -0.759 means negative correlation and is high. The significance value of X_1 is 0.000 < 0.05 so that H_o is rejected, it means there is correlation between X_1 variable to rework as quality performance. This indicated leadership style, leadership behavior and leadership policy play a role in project cycle. Transformational style of leadership has strong correlation in project success at South Africa [10]. Otherwise this result in harmony with working in complex

environments, the human decision makers can always face situations where time constraints, high stakes, multiple players, ill-structured problems and situations are presenting strategic decision making the information is used to make high-risk decisions [7].

2) Commitment (X_2) variable correlation with rework construction of pilot plant is -0.763 means high negative correlation. The significance value of X_2 is 0.000 < 0.05 so that Ho is rejected, it means there is correlation between X_2 variable to rework as quality performance.
3) Infrastructure and environmental work (X_5) variable correlation with rework construction of pilot plant is -0.610 means negative correlation and is moderate. The significance value of X_5 is 0.000 < 0.05 so that Ho is rejected, it means there is correlation between X_5 variable to rework as quality performance. This factor is an indicator of support to provide the required resources at the operational stage to achieve product conformity.

Different result with the three before shows as follows:

1) Responsibility and Authority for the management system (X_3) variable correlation with rework construction of pilot plant is 0.101 means positive correlation and is negligible. The significance value of X_3 is 0.557 >0.05 so that Ho is accepted. It means there is no correlation between X_3 variable to rework as quality performance. It is because this factor more likely to affect at the organizational level than rework level which is project level. This factor reflected the organizational roles.
2) Organizational policy (X_4) variable correlation with rework construction of pilot plant is 0.175 means positive correlation and is negligible. The significance value of X_4 is 0.307 >0.05 so that Ho is accepted, it means there is no correlation between X_4 variable to rework as quality performance. This factor reflects the organizational policy establish. Like X_3, this factor influences the organizational level.

The whole analysis result can be seen on Table 5.

Table 5. Summary of correlation analysis

Factors	Result	
	coefficient correlation	***p*-value (α=0.05)**
X_1	-0.759	0.000
X_2	-0.763	0.000
X_3	0.101	0.557
X_4	0.175	0.307
X_5	- 0.610	0.000

Data from 36 selected respondents about influence the leadership and commitment to rework level, and rework level at the pilot plant. Among the five (5) factors in the focus area the commitment and leadership factors has strong correlation with rework that occurred in the project. Moreover, infrastructure and environmental work shows moderate correlation to the rework level. Findings further revealed negligible correlation between responsibility and authority for the management system with rework level of the project and lastly, there is no correlation between organization policy and rework level.

CONCLUSION

The findings of this research provide contribution in nuclear facilities constructions especially construction of the processing nuclear material. Whereby provide guideline

and alert to project managers or management of organization to identify the leadership style, leadership behavior and particularly leadership policy in strategic decision to delivered quality performance with decreasing rework level at the project. Besides commitment must be maintained, to emphasize that the agreed terms related to the quality of construction become the things that should be respected and fulfilled by all stakeholders. Likewise infrastructure and work environments to support the provision of resources for continuous improvement of project quality and must be concerned by all stakeholders. Linking leadership and quality are encouraging the organizational improvement. Taken a holistic perspective examining how quality management system can lead to simultaneous improvement project success.

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