Evaluation of risk quality control in construction company

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Abstract. Risk becomes one of the unexpected things that can happen and causes the project target not to be achieved according to the plan. Risk is a situation where there is uncertainty and the level of uncertainty can be measured quantitatively and can cause loss. This study aims to identify dominant (high) risk in the quality control process, especially in construction projects, which can result in not achieving the output indicators of the Project Quality Management Process according to the Project Management Body of Knowledge (PMBOK) 6th edition 2017 and steps to be taken to improve the existing Quality Management System against dominant (high) risk. The method used in this study are literature review and archive analysis, expert validation, pilot survey and respondent questionnaire. The results of this study found that there were 3 dominant (high) risks that affected the implementation stage of quality control, namely the error of contract document review, multiple interpretations of contractual material (equipment and material specifications) and the contents of contract documents (addendum). Steps taken to improve quality control related to the dominant risks found include developing procedures related to employee competencies in particular the project team and updating existing procedures related to Contract Administration.

1. Introduction
Project is an activity carried out to achieve a certain goal that is limited by time and limited resources, while construction is all activities to build a building or any other structures [1]. Construction Project is an effort to achieve an outcome in the form of buildings or infrastructure [2]. The project cycle is a series of activities that start from the initial investment initiation of the project until it is used. The series and interrelations of activities in the project cycle are very many and with a high degree of complexity [2]. In addition, the complexity is compounded by many external factors and various internal factors that are sometimes difficult and uncontrolled.

Every construction project is expected to run well and achieve results according to plan. But it cannot be denied that there are some unexpected things that could have happened so that the project that was being worked on did not go according to plan. To prevent this, project quality control is needed. Quality control in a project consists of three main steps namely quality planning, quality manage and quality control itself. The quality control section should also have quality control technical guidelines that are carefully arranged and certainly agreed upon. The technical guidelines for quality control contain background and understanding of quality control in the project, quality control procedures, quality control strategies, quality control objectives, and methodologies used, quality control stages, and performance evaluation.
Risk becomes one of the unexpected things that can happen and causes the project targets to not be achieved according to plan. Risk is a situation where there is uncertainty and the level of uncertainty can be measured quantitatively and can cause losses [2]. In the construction project industry there are various types of risks and uncertainties, which sometimes exceed those of other industries [2]. Construction project risks are generally considered to be events that affect the objectives: cost, quality and time [2]. Each stage of the project cycle cannot be separated from various risks that affect both in terms of quality and quantity. In an effort to control various risks that occur in construction projects, the implementation of risk management in various stages of the project cycle and in the implementation of construction projects have been carried out.

Wijaya Karya Ltd. Company is a construction company owned by the Government of Indonesia. It was established based on dated March 29, 1961. A strong capital structure strongly supports this company in expanding its operations overseas and continues to develop Engineering Procurement and Construction (EPC), as well as investing in and developing a number of infrastructure projects, especially projects that become government programs related to the State Budget (APBN) and the Regional Budget (APBD). This company currently has 6 Strategic Business Units (SBU) which include construction (Civil Construction and Building construction), Mechanical Electrical, Pre-cast Concrete Industry, Real Estate and Other Industries that will be integrated into the Engineering Procurement Construction (EPC) company in the future and investment.

Project Management Body of Knowledge (PMBOK) is a standard established by the Project Management Institute (PMI) with the aim that the document becomes the main reference in project implementation [3]. It is hoped that by reference or what we call best practice, it can provide quality results with complexity that is easily understood and it will be updated periodically in response to the up to date best practice available.

2. Research objectives
The objectives of this research are:
- To identify which indicators can support the achievement of outputs in the Project Quality Management Process at a Construction Company.
- To identify dominant (high) risk factors in the quality control process that can cause the achievement of indicators of the output of the Project Quality Management Process in a Construction Company.
- To improve the risk-based quality management system in anticipating the emergence of dominant risks (high risk) in the quality control process in a Construction Company.

3. Literature review

3.1. PMBOK 6th edition 2017 (project quality management)
Project quality management includes processes to incorporate an organization’s quality policy which includes planning, management, and project control and product quality requirements in order to meet stakeholder objectives [3]. Project quality management also supports the process of continuous improvement activities as the organization carries out. Project Quality Management addresses project management and project results [3]. This applies to all projects, regardless of the nature of the results. Quality and technical measures specific to the type of results produced by the project. For example, project quality management uses different approaches and steps when producing software compared to when building nuclear power plants. In both cases, failure to meet quality requirements can have serious negative consequences for any or all project stakeholders.
3.2. Construction project
A construction project is a series of interrelated activities to achieve certain goals (building / construction) within certain time, cost and quality limits. Construction projects always require resources, namely man (human), material (building material), machine (equipment), method (method of implementation), money (money), information (information), and time (time). In a construction project there are three important things that must be considered namely time, cost and quality [1]. The overall project will end after all construction items and commercial aspects meets on the project closing state and continue the handing over of the project process to the owner.

3.3. Risk management
Risk management is a general management application that is associated with various activities that can create risks. Definitions of risk management vary, but basically risk management is related to the ways used by a company or institution to prevent or overcome various risks faced [2]. Including the processes involved in carrying out risk management planning, identification, analysis, response, and project monitoring and control, most of these processes are updated throughout the project. Purpose area:

- Increase the probability and impact of positive events.
- Reduce the probability and impact of adverse events with the project.

4. Methodology
This research using qualitative approach to achieve the improvement of construction project quality management. Here, in figure 3 the research flow diagram conducted to implement this study.

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**Figure 1.** Project quality management overview [4].

**Figure 2.** Probability and impact matrix with scoring scheme [4].
Figure 3. Research flow diagram.

4.1. Questionnaire and data collection

In this study there are 3 (three) 3 phases of data collections to expert, targeted respondents, then back to expert validations:

- Initial questionnaire in phase I is delivered to 6-7 experts to validate the quality management project outputs and indicators related to construction project in Construction Company. The validation process contains expert response to agree/disagree to the quality management project output and indicator prepared.
- Phase II contains two questionnaires, first (a pilot survey) distributed to 4-5 respondents with minimum experience 4 years and or at the managerial level in the Quality Management to obtain feedback about respondent understanding of the risk factors and also grammar check of the questions. Second (respondent survey), 139 questionnaire delivered to obtain the highest risk value of the risk factor. Distributed to respondents who are/have worked in the process of construction project with experience of at least 1 years
- Phase III data collection is the last validation by expert aimed at soliciting expert responses related to the research result of risk analysis while discussing the risk causes, preventive actions, and its impact to the project quality implementation and performance in construction project. Steps taken to improve quality control related to the dominant risks found include developing procedures related to employee competencies in particular the project team and updating existing procedures related to Contract Administration.

4.2. Respondent

A total of 48 respondents, the profile is defined in the table 1 as follows:

Table 1. Respondents profile.

| No. | Description           | Total | (%)     |
|-----|-----------------------|-------|---------|
| 1.  | Position              |       |         |
|     | Staff                 | 13    | 27.08%  |
|     | Manager/Equivalent    | 29    | 60.42%  |
|     | Project Manager       | 6     | 12.50%  |
| 2.  | Work Experience       |       |         |
|     | 0 - 5 years           | 15    | 31.25%  |
|     | 6 - 15 years          | 28    | 58.33%  |
|     | 16 - 30 years         | 4     | 8.33%   |
|     | > 30 years            | 1     | 2.08%   |
| 3.  | Education             |       |         |
|     | High School/Equivalent| 1     | 2.08%   |
|     | D3 (Associate)        | 2     | 4.17%   |
|     | S1 (Bachelor)         | 43    | 89.58%  |
|     | S2 (Master)           | 2     | 4.17%   |
5. Results and discussion
The result of this study are as follows:

5.1. To answer RQ1
From the results of the previous data described as an indicator of the outputs it will be validated by experts then refined in a pilot survey and discussion with construction company employees who have been involved in project quality management activities. Few validated indicators will be shown in table 2 below:

| No. | Knowledge Area | Project Quality Management Process | Output | Indicator |
|-----|----------------|-----------------------------------|--------|-----------|
|     |                | PMBOK 6th 2017                    | XYZ Company |
| 1.  | Planning       | Output                            | Plan quality management | Quality Plan |
|     |                |                                   | 1.1.1 Study and or review contract documents in detail |
|     |                |                                   | 1.1.5 Compile the specifications of tools and materials based on contract specifications. |
|     |                | Project Document Updates          | Contract Document (Addendum) | 1.4.1 Study and or review Contract Documents (addendums) |

5.2. To answer the RQ2
The number of risk factors have been validated will be distributed to respondents to obtain the highest risk value of it, that affecting the indicators from the output of project quality management process, the dominant (high) risk as table 3 shown below:

| No. | Dominant Risk                                                                 | Level | Rank |
|-----|-------------------------------------------------------------------------------|-------|------|
| 1.  | Misinterpretation in reviewing contract document                             | High  | 1    |
| 2.  | Contractual matter (Specifications of tools and materials) contains multiple interpretations | High  | 2    |
| 3.  | Multiple interpretations of the contents of contract documents (addendum)     | High  | 3    |

5.3. To answer the RQ3
After obtaining a dominant risk factor (high risk) as can be seen from table 3 above, the next step is to conduct action (risk management) to the risks identified as dominant risk (high risk) so that it is expected to reduce the impact of these risks in the implementation process quality control. Expert validation will also be carried out on the risk mitigation applied to the dominant (high) risks, so that the risk management that is carried out is valid.

6. Conclusion
Based on the results of the analysis that has been performed then it could be concluded as follows:
• 65 indicators from 53 output items from the quality management process have been obtained, where these elements will be used as evaluation quality control risk based in Construction Company.

• The results of this study found that there were 3 dominant (high) risks that affected the implementation stage of quality control, namely the error of contract document review, multiple interpretations of contractual material (equipment and material specifications) and the contents of contract documents (addendum).

• Steps to be taken to improve quality control related to the dominant (high) risk found include developing procedures related to employee’s competencies in particular the project team and updating the existing procedures related to Contract Administration.

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