

# Quality Management System Analysis in Toll Road Construction (Case Study: Bogor Ring Road Toll Road)

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## ABSTRACT

One of the ways for Indonesia to gain economic equity is by building toll road. Toll road becomes one of the National Strategic Projects (Proyek Strategis Nasional - PSN) of Indonesia to connect all areas expanding from the suburbs to the cities. PT.Marga Sarana Jabar is one of them, connecting Bogor outer ring road area to Jakarta, Sukabumi, and Balaraja. Toll road operator must provide a comfortable road trip to the users. They have to minimize any congestions, damaged roads, or other inconveniences. One of the roots causing any inconveniences comes from the quality delivered during toll road construction did not comply to the standards. Quality Management System (QMS) during construction can ease the supervisor to monitor the quality. However, there were troubles during the implementation of QMS in construction. Hence, this research was conducted by using primary and secondary data obtained from archive and questionnaires. The method of analysis used qualitative analysis that also supported with Nvivo tools to identify the highest possibility factors causing poor quality. The main conclusion of this research is that human resource significantly affected the success implementation of QMS. Appropriate training of human resources will be immensely required to improve the construction quality.

**Keywords:** *Quality Management System (QMS), Bogor Ring Road (BRR).*

## 1. INTRODUCTION

### 1.1. Background

Economic growth in a country is closely related to good infrastructure development. By increasing the quality of infrastructure of a country, it can support, encourage, and drive national development to increase people's welfare. Massive infrastructure development that spread in various regions is a form of the "Regional Growth Strategy" with the main function to overcome the problem of poverty and discrepancy, as well as a form of investment in increasing productivity and competitiveness [1]. The Indonesian government is currently focusing on accelerating the development of infrastructure in various regional connectivity in Indonesia to remote areas with the aim to make regions connections because sustainability between regions is the key to mobilize the economy. Each different potential requires connecting facilities such as road infrastructure, airports, harbors, and electricity, all four

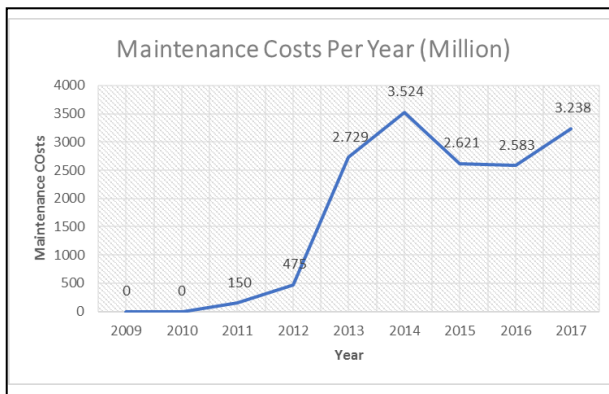
of which are part of the National Strategic Project (Proyek Strategis Nasional - PSN). The road infrastructure development project is one of the 5 (five) lists of PSN projects that requires the highest investment costs.

One of the PSN Programs is the Bogor Ring Road (BRR) Toll Road owned by PT. Marga Sarana Jabar. The BRR Toll Road connects four major sections in the Bogor area: Depok - Antasari (Desari), Salabenda - Balaraja, West Karawang - Salabenda and Salabenda - Dramaga. The BRR Toll Road is important in helping to raise the economy in the Jabodetabek area because the BRR Toll Road connects Bogor area with the Inner Ring Road, Sukabumi and Jagorawi Toll Road to accelerate the mobilization of products and services trading.

- The Bogor Ring Road (BORR) Toll Road Project consists of several sections:

- Section 1 (South Sentul - Kedung Halang) of 3.85 km (in 2009)
- Section 2A (Kedung Halang - Kedung Badak) of 1.95 km (2014)
- Section 2.B (Kedung Badak - Simpang Yasmin) of 2.65 km (2018)
- Section 3A (Simpang Yasmin - Simpang Semplak) is 2.85 km long
- Section 3B (Simpang Semplak – Salabenda) for 2.50 km.

Sections 1, 2A and 2B have been operated, to date, up to 30,000 vehicles/day use BRR Toll Road. The planned lifetime for concrete construction reaches 10 years, while for asphalt reaches 5 years. However, the realization of concrete and asphalt reconstruction has been carried out before the planned lifetime. This has an impact on reduced profits from PT. MSJ as it can be seen from the costs incurred for reconstruction from the 2009 operating year in Figure 1.



**Figure 1.** Maintenance Costs (in Million) of Bogor Ring Road Toll Road

PT. MSJ has only operated since 2009, but has spent maintenance costs in 2011 of Rp150,000,000, which then increased in 2012 amounting to 475 million rupiah. In 2013, asphalt repairs occurred so that the costs incurred reached 2.73 billion Rupiah. In 2014 there was large construction damage to the concrete, so PT. MSJ had to pay 3.52 billion Rupiah to repair the damaged construction and in the following year the maintenance rate was more than 2 billion rupiah.

Traffic jam also arises due to toll road repairs, and the lines can reach hundreds of meters. This is detrimental to both road users and toll road owner. Delays can have a negative impact on the economy. Most economic interests depend on trade and workers; especially in urban areas, this delay has a negative impact on business activities. When workers have to travel long distances to the workplace, it is clear that traffic jam has an impact on time and costs [2].

There has been damage to the road of the BRR Toll Road in the form of cracked concrete and damaged asphalt roads. Damage experienced often before the material planned lifetime ends, and this is detrimental to both the company and toll road users.

QMS (Quality Management System) in construction industry refers to quality planning, quality assurance and, quality control. QMS is also a continuing process of improvement involving all aspects of the business. QMS will not work without a total commitment and involvement from top management. Managers, in all areas of the company, must provide employees with the proper training, tools, equipment and work place environment to accomplish the assigned task [3].

Managing project quality focuses on the process than to the results. This is because the quality of good results is only generated by the good quality process of managing since the start of the project [4]. Reference [5] said that top management has begun to focus on the need to apply the quality philosophy to get high levels of performance in various components and procedures. However, quality is sometimes abandoned during construction to reduce costs and shorten the duration of the project [6].

**1.2. Literature Review**

Reference [7] defined project as an attempt to carry out activities that are of a temporary nature to create unique products, services, or results.

In project management there is something called "Triple Constraint" or in other words, it is called a benchmark for successful project management. In project management, it is always believed that a project in its implementation must meet 3 (three criteria) consists of cost, quality, and time. Project costs must not exceed the planned or agreed-upon limits, or the project costs must be in accordance with the contract. The quality of the final results of the work and the process/method of carrying out the work must meet certain standards in accordance with the agreement, planning, or work contract documents. The time for completion of work must meet the agreed time limit in the planning document or the work contract document in question. So that in reality, 3 (three) criteria that become the nature of the project are the responsibilities that must be met by the project manager.

Reference [8] stated that in the project management cycle there are 3 stages that must be considered in each project implementation: Project Planning, Project Scheduling, and Project Control.

Planning is a very important management function. In fact, most management considers planning as the most important function. In planning, we first determine what must be done to fulfill a project, determine the

order of work, and specifically the relation between the works [8].

PMBOK 5th said that project scheduling provides a detailed plan that represents how and when a project will produce a product, service, and results defined in the work environment and displays communication tools, controlling stakeholder expectations and performance reporting.

Project control is the main key when executing a project [9]. Achieving predetermined targets during planning in the construction period is done by measuring performance that is verified through the use of tools provided during construction with the aim of controlling the project [10].

Based on PMBOK 5th, the quality management planning process is a process for identifying standards and requirements for quality and results of work, and also documenting to show how the project can meet the criteria for quality standards that have been set. This process can provide direction guidance regarding the procedures for quality to be managed and validated throughout the project.

The project quality management planning process is recommended to be described as a series of activities to make it easy for both project planners and project employers to understand and implement this process [4].

PMBOK 5th stated that the implementation of quality assurance is a process in which an audit of project quality requirements and results of quality measurements is carried out to ensure that the quality standards that have been set are appropriate. The benefit of this implementation is enabling to facilitate to improve the project quality process [4].

## **2. METHODS**

### **2.1. Research Approach**

This study was an exploratory case study research that is used to define research problems and explore information needed by research [11]. The problem in this study was the quality that was not in accordance with the planned lifetime that had been set at the beginning before the commencement of construction.

Data collection techniques are techniques or methods used in data collection. This data collection aims to obtain information needed in order to achieve the research objectives. This study used primary data and secondary data with following details

SD is a computer simulation method for understanding systems and how they change in terms of feedback mechanisms or loops [5]. There are 6 steps to simulate using system dynamics.

### **2.1. Primary Data**

Primary data is data obtained directly from the object of research. This primary data can be collected by conducting interviews. In this study, the respondents were divided into two parts, they were the Engineering division as a division that dealt directly with decision making in the Bogor Ring Road Toll Road project (PT Marga Saran Jabar/Project owner), and some construction experts who were indirectly related to project decisions taking but having expertise in the field of toll road construction including carrying out management of a toll road construction project (Expert division). Interviews to two different division of respondents were done to see the procedures for implementing quality of each part of a construction project from the point of view of the project owner (PT Marga Sarana Jabar) and the experts (lecturers and practitioners) regarding the implementation of quality management on the project.

### **2.3. Documentation**

Documentation is one of the evidences used to strengthen case study research, which can be in the form of letters, official announcements, agendas, administrative documents, official studies, evaluations or articles that appear in the media [11]

The benefits from the documentation are first the documents can help verify the spelling and title or correct names of the people in the organizations mentioned in the interview. Second, documents can add other specific details to support information from other sources. Third, the initial hypothesis can be made from the documents obtained [11].

### **2.4. Archive Records**

Computerized archive records were used in emphasizing evidence for the research. The archived records were in the form of toll road recordings during road repairs, organizational records, maps and geographical charts of BRR Toll Roads, traffic survey data that crosses the BRR Toll Road, and personal records [11].

### **2.5. Interview**

A typical case sampling approach strategy was used, where the informant can provide an overview of the typical case that occurs in several places with the same phenomenon. Informants who are selected and considered to be able to represent are key informants who have a special connection to the phenomenon that occurs.

In accordance with the references available in qualitative research, the informants chosen were the ones who had a direct relationship with the quality at the time the construction project proceeded at PT. MSJ. Because

this research was directly related to quality, the informants' general criteria are:

- In Adult age
- Working at PT. MSJ
- Having responsibilities related to quality during construction

A structured interview was conducted by preparing several questions related to the implementation of the project quality management so that the quality in the construction of the BRR Toll Road could be analyzed.

**2.6. Secondary Data**

Secondary data is data taken from previous research. Secondary data can help identify problems and describe the results of the primary data in the analysis chapter. Secondary data was collected from journals, literature, textbooks and other official documents relating to construction and quality management.

**2.7. Nvivo 12**

NVivo is a software that supports qualitative and mixed methods research. It is designed to help organize, analyze, and find insights in unstructured, or qualitative data like interviews, open-ended survey responses, articles, social media and web content.

Research approach and method were adopted from several previous studies with some modification to comply condition of PT. MSJ. All causes of delay were referred from previous studies because variables that caused delay at project must be considered to all variables [12]. However, certain filtration needed in order to achieve variables that applicable and comply to PT. MSJ. Filtration applied with conducting several interviews with professionals in PT. MSJ. Professionals refers to person who has experience in managing project for more than 15 years and at least has completed bachelor's degree study. After interview has conducted, filtered variables tested with statistical method with data collected from questionnaire.

**3. RESULTS AND DISCUSSION**

Not only PT.MSJ but also contractor and consultant were also being interviewed because they could make decision and manage in the field. Table 1 shows the respondents' profile involved in the interview.

**Table 1.** Respondent Profile

Code	Position	Working Experience	Last Education
Owner			
I1	Head Director	25	S2
I2	Engineering Director	21	S2
I3	Project Leader	21	S2
I4	Engineer Manager	18	S2
I5	Engineer Staff	11	S1

I6	Assistant Manager	4	S1
I7	Experts	29	S1
Contractor			
I8	Deputy General Superintendent	10	S2
I9	Quality Assurance	8	S1
Consultant			
I10	Team Leader	27	S2
I11	Quality Engineer	14	S1

Respondents were asked questions related to QMS in Bogor Ring Road Toll Road Project, including 'What is the QMS like in PT.MSJ?' and 'Why is QMS important?' Several questions were also asked to elicit further information, using questions such as 'Can you provide me with an example?' and 'What do you mean by that?' as a means to avoid 'leading the respondent; and thereby adopting a phenomenographic approach. The central concept is taken up the word 'quality' with 'management', 'factor' and 'ultimate' being the core of those things the managerial trying to explain QMS. Surrounding this core there are also factors that making the QMS was not executed as standard project management. QMS associated with the success of quality during the project construction. Other concepts such as 'quality', 'human resource' and 'time' highlight the QMS attributes in PT.MSJ.

Regarding the interview that had been done, all of the respondents said that the quality is crucial to the success of the project and to the company. The comments included:

- Respondent 4:  
 "Very important, management quality is number one, because good management quality will minimize rework construction as it will decrease the maintenance costs spent every year."
- Respondent 5:  
 "Very important, because when in the project, quality will be a crucial factor to the maintenance costs. Because ever since I have been in PT.MSJ from 2009 up until now, the construction will impact highly on the maintenance costs."

Regarding to [13], the main objective during the quality implementation for company is that to decrease the costs. Quality is important to the implementation construction. Management quality is the process with the objective to comply the product with the standard given. Quality is the element that is seen and felt by all stakeholders in the project either it is internal or external. The importance of quality in the project making is that if it is not conducted, the quality will decrease the profit of the company itself [4].

It was found that 'human resource is the most important thing that must be improve'. Human resource is the core power to create quality as stated in the

standard book [4]. As in the Figure 2, there were 23 (0,66%) times in total mentioned during interview with contractor, consultant and also PT.MSJ management.

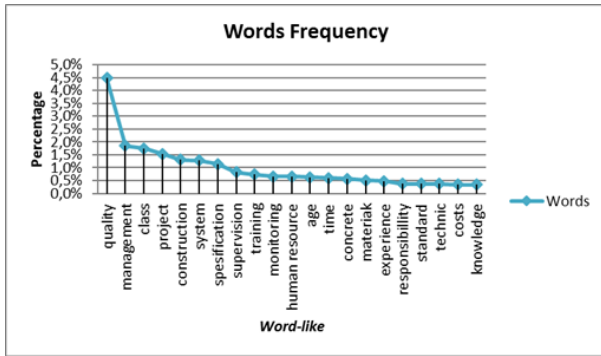


Figure 2. Word like frequency (Nvivo 12 Tools)

Examples of such responses included:

1) Respondent 1:

“The competence of human resource is the core to have a good quality result. If you have good quality of human resource, it is almost sure that your result would be good also. Otherwise, even you have many human resources, but none of them is capable handling the task given, it would be hard to have good quality. Sometimes you also have to control to gain perspective whether the quality is according to standard, not only trusting your personnel to watch the quality”

Respondent 2:

“The point is going back to the owner of human resource, which is also an important thing to talk to. Do not let contractor and consultant giving report and administration only to get paid. Data that is gathered from the owner of human resource must be completed also later to be compared with data from consultant and contractor, because lack of data will be a weakness to maybe later be attacked by the contractor. Thus, it is crucial to have good quality of human resource”.

Respondent 7:

“Factor that cause quality planning not comply to the realization is caused by the human resource. Human resources do not have any training regarding to the construction. Often, the human resources that checks assign the quality did not understand completely about it.”

Respondents were then asked to describe their perspective of how to improve the QMS as to increase the profit of company. Most of them told that to improve the QMS human resource must have proper training regarding to the construction. As it was mentioned during the interview with the respondents:

1) Respondent 6:

“Must give training about construction, so that it will be a new knowledge to us because all this time we have not received any of training related to construction. This training will be helpful to us to do the monitoring during construction”

Respondent 1:

“...to improve capability through trainings regarding quality that will be implemented, in this case construction, either rigid or flexible construction. Beside training, individual must have the sense of curiosity and willingness to gain knowledge. Do not cling only to the training that is given, but also cravenness to knowledge”

Respondent 4:

“Regular monitoring will be needed. However, if the person in charge is not given a proper training, it will be hard for them to monitor the construction correctly. If they only watch the construction being done and do not understand what is going on, it will be just a waste. Training shall be held about 4 times a year”

The success of a project will highly depend on the uniformity of capability from human resource [14, 15]. National construction industry must find a way to increase the capability technology, management, and professionalism of human resource [16]. Therefore, development of human resource with trainings is a crucial strategy in company [17].

4. CONCLUSION

This paper presents analysis of quality management system causing the occurrence of defects on construction at Bogor Ring Road Toll Road. The results revealed that human resource had a big influence on the occurrence of construction defects on construction. This indicated that the quality of human resource needs to be improved with proper training.

Future research opportunities may include kind of training regarding quality as such QMS construction to ease the person to monitor quality of project with proper knowledge. Area utilization rate may also be worthwhile.

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