Risk Analysis of Underestimate Cost Offer to The Project Quality in Aceh Province

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Abstract. The possibility of errors in the process of offer price determination could be enormous, so it can affect the possibility of project underestimate cost which can impact and reduce the profit if being implementing. Government Equipment/Service Procurement Policy Institution (LKPP) assesses that the practices of cheaper price in the government equipment/service procurement are still highly found and can be potential to decrease the project quality. This study aimed to analyze the most dominant factors happened in underestimate cost offer practice, to analyze the relationship of underestimate cost offer risk factors to road construction project quality in Aceh Province and to analyze the most potential factors of underestimate cost offer risk affecting road construction project quality in Aceh Province. Road construction projects observed the projects which have been implemented in Aceh Province since 2013 – 2015. This study conducted by interviewing Government Budget Authority (KPA), and distributing the questionnaire to the road construction contractors with the qualification of K1, K2, K3, M1, M2 and B1. Based on the data from Construction Service Development Institution (LPJK) of Aceh Province on 2016, the populations obtained are 2,717 constructors. By using Slovin Equation, the research samples obtained are 97 contractors. The most dominant factors in underestimate cost offer risk of the road construction projects in Aceh Province is Contingency Cost Factor which the mean is 4.374.

1. Introduction
Before construction project implementation process carried out, the project’s owner needs to conduct bidding process to choose the contractor who will carry out the project. Bidding activity process is one phase which must be followed by the constructor in the effort to receive the construction project. The contractor successful in the competition is reflected by the ability to win the bidding process. To win the competition in the bidding process is required the realistic and good estimation offer by improving the calculation accuracy. For this reason, cost engineer role in cost estimation activity process will become very crucial. Generally in handling project cost uncertainty depends on how well the cost engineer can produce accurate cost estimation. The project cost uncertainty can occur in the end of the project finishing period which can be seen from the cost estimation differentiate between the cost which had been compiled in the early design period and the cost of the final project cost. The possibility of errors in the process of offer price determination could be enormous, so it can affect the possibility of project underestimate cost which can impact and reduce the profit if being implementing.
Government Equipment/Service Procurement Policy Institution (LKPP) assesses that the practices of cheaper price in the government equipment/service procurement are still highly found and can be potential to decrease the project quality. Head of LKPP mentioned that there are constructors offering low bidding cost and this condition gives the benefit to the government, but these cheaper price practices will affect the reducing of the quality of equipment or infrastructure projects. Meanwhile according to Indonesia Contractor Association (AKI) assesses that government equipment/service procurement system for the infrastructure project using the lowest price becomes the main trigger of the low quality of the contractor in Indonesia (Bisnis Indonesia, 2009).

Based on the above background, the problem from this study is to find the what most dominant factor causing underestimate cost offer risk is, how the relationship of underestimate cost offer risk factors to road construction project quality in Aceh Province is, and what the most underestimate cost offer risk factor affecting road construction project quality in Aceh Province is. The study aimed to analyze the most dominant factors happened in underestimate cost offer practice, to analyze the relationship of underestimate cost offer risk factors to road construction project quality in Aceh Province and to analyze the most potential factors of underestimate cost offer risk affecting road construction project quality in Aceh Province.

The projects reviewed are the road construction projects which had been implemented in Aceh Province since 2013 – 2015, which budget resources come from APBA (Aceh Income Budget). The observation is carried out to the owner, and the contractors which related to the road sector especially SI003 Sub sector starting from the qualification of K₁, K₂, K₃, M₁, M₂, and B₁. Based on the data from Construction Service Development Institution (LPJK) of Aceh Province on 2016, the populations obtained are 2,717 constructors. By using Slovin equation, the research samples obtained are 97 contractors. The interview in this study is carried out to the owner represented by Government Budget Authority (KPA). Independent variables reviewed in this study are bidding document review factor, location review factor, working method factor, project implementation schedule factor, quantity take off factor, information collection factor, direct cost factor, indirect cost factor and contingency cost factor, while the dependent factors is road project quality. Statistical analysis used in data processing is the reliability test, whereas for data analysis consisted of descriptive analysis, bivariate correlation analysis, logit regression analysis using SPSS (Statistical Product and Service Solution) version 22 software.

2. Literature study

2.1. Road project

Soeharto (2001) mentioned that the project can be defined as the temporary activity carried out in the limited time period, with the limited resources allocation and meant to the task which the objectives have been outlined clearly.

Gould and Joyce (1994) stated that the road construction project is an activity which aims to construct a road construction requiring the resources, such as cost, worker, material and equipment, so that the road can serve the traffic load in accordance with the design period.

2.2. Project cost estimation

Another opinion is stated by Soeharto (2001), the cost estimation is the art to estimate the possibility of cost amount required for an activity based on the existing information at that time. Cost estimation plays an important role in the project implementation. On the first level is used to determine how much cost required to construct the project, then it has a function with extensive spectrum to plan and control the resources such as material, worker, and time.
2.3. **Underestimate cost risk**

Project Management Institute (2008) stated that the risk is an uncertain event, which if it happens, it will have any negative or positive impacts to the project goals and objectives.

Waddle (2009) mentioned that in the estimation activities carried out by cost estimation engineer, the possibility of failure activity occurrence in achieving the objectives of the estimation activity will be possibility happen. This can affect inaccurate of project cost estimation which is calculated in the bidding process. Inaccurate of project cost estimation can allow overestimate cost and underestimate costs, so it can affect the bidding cost, either it is too high (overprice) which can decrease opportunity to win the bidding or it is too low (under price) which affect the loss because it can reduce the profit expected and finally can impact the company bankruptcy.

2.4. **The factors of underestimate cost bidding risk**

Riyanta (2010) argued that underestimate cost bidding risk occurred in a construction project consist of some factors. The factors can be explained as follows.

1. **Tender document review factor**
   Humphreys (1991) stated that in the review of the tender documents should focus on how the cost estimation must be calculated and and ensure that the document is complete, the work items are clear and familiar; then create a checklist to avoid the mistake in learning the tender documents.

2. **Location review factor**
   Latif (2009) argued that location review aims to collect the information related to the method and cost required in preparing the bidding.

3. **Working method factor**
   Clough, et al. (2000) argued that the working method planning is a planning process in the determination of technologies and methods to be used to carry out the work in accordance with design and specification requirements.

4. **Implementation schedule factor**
   Another opinion was stated by the Project Management Institute (2008) that the resources type and amount and the time are the resources required to complete the project, mostly determined in project costs. The activity schedule of the resources and time period required to complete the work items become the key in this activity. The calculation of resource amount related to the availability and amount of workers and the need of each work item required as a basis to manage a schedule for each activity. The calculation of the completion duration of each work item will affect the cost.

5. **Quantity take off factor**
   Tebin (2009) mentioned that quantity take off it is closely related to the calculation of material and equipment amount required in the project completion. The accuracy level of in conducting quantity take off will affect the project cost estimation and the final bidding cost. The understanding of the specifications, drawings and work sequence will affect in carrying out the quantity take off.

6. **Collecting information factor**
   Hannon (2006) argues that the use of database or data history consisting of the information of material prices, wages, equipment and subcontractors as well as productivity information from previous projects is needed as a reference in the project cost estimation on the next project so that the calculation is more accurate.

7. **Direct cost factor**
   Another opinion was stated by Soeharto (2001), the direct cost is the cost raised and directly related to the ongoing project activities. Direct costs include the material cost, worker cost, and the equipment cost.

8. **Indirect cost factor**
Another opinion was stated by Soeharto (2001), the direct cost is the cost that is not directly related to construction, but there must be and cannot be removed from the project. These indirect costs include overhead cost, profit, unexpected cost and Value Added Tax (VAT).

9. **Contingency cost factor**

Another opinion was stated by Humphreys (1991) that amount of the bidding price consists of direct costs added by indirect costs and then added by mark up cost. Mark up cost including contingency cost and profit. The amount of the contingency cost is calculated based on contract risk identification obtained using some approachment such as range estimate, monte carlo or other approachments. The risk cost must be calculated using the correct assumptions, the mistakes in estimating the risk cost will impact the lack of bidding price accuracy. The risk cost should be given to possibility conditions that will be happen and there must be a clear reasons for the risk cost allocations.

2.5. **Project quality**

Rothery (1995) found that the quality is the overall characteristics of the products or services that can satisfy the needs stated whether explicitly or disguised.

Another opinion was stated by Soeharto (2001), the quality is the form or product characteristics (goods or service) that meet and prioritize what is desired by the service user.

Permono and Mulyono (2015) argued that the indicators of the quality of the road construction are: to provide maximum service in accordance with the function and design period; the availability of quality road construction material; the ability and availability of equipment when the implementation of the road construction activities; and good worker both quality and productivity.

3. **Research Methodology**

This research was conducted in the Aceh Province, which is addressed to Construction Company or road sector contractors with the companies’ qualifications are K1, K2, K3, M1, M2, and B1 and located in Aceh Province.

The data used in the study is list of the road sector contractor companies registered in National Construction Service Development Institution (LPJK) of Aceh Province in 2016 with SI003 sub sector, the questionnaire data and Interview.

Based on LPJK data on February 19th, 2016 the total of contractors from the qualification of K1, K2, K3, M1, M2, and B1 located in Aceh Province are 2,717 contractors. The sample used in this study is 97 contractors. The sample proportion of each qualification can be shown in Table 1.

| No. | Qualification | Population | Sample |
|-----|---------------|------------|--------|
| 1   | K1            | 2,019      | 24     |
| 2   | K2            | 245        | 21     |
| 3   | K3            | 172        | 18     |
| 4   | M1            | 214        | 15     |
| 5   | M2            | 51         | 12     |
| 6   | B1            | 16         | 7      |
|     | **Amount**    | **2,717**  | **97** |
The sampling technique used in this study is purposive sampling (intentionally sampling) with the contractors qualification is K1, K2, K3, M1, M2, and B1 which have completed the road constructions since 2013 to 2015, with the budget from APBA of Aceh Province.

The variables in this study consisted of independent variable (X) and the dependent variable (Y). The independent variable is underestimate cost bidding risk, while the dependent variable is the road construction projects quality.

4. Result and Discussion

4.1. Reliability test
Based on the Cronbach Alpha values, the values obtained is 0.81 to 1.00, indicating that they are very reliable. Thus the reliability test which is carried out to all of the variables is very reliable.

4.2. Descriptive analysis
Based on the distribution of the questionnaires to 97 respondents of the road sector contractors showing that some of the respondents are 31-40 years old which are 52 respondents (53.61%); 20-30 years olds which are 22 respondents (22.68%); 41-50 years old which are 14 respondents (14.43%); and more than 50 years old which are 9 respondents (9.28%).

Based on the latest education showing that bachelor degree are 61 respondents (62.89%); master degree are 17 respondents (17.53%); high school degree or equal are 10 respondents (10.31%), and Diploma degree are 9 respondents (9.28%).

Almost half of the respondents are field officer which are 35 respondents (36.08%); the director and site manager are 23 respondents (23.71%), director are 17 respondents (17.53%), quantity engineers are 12 respondents (12.37%), quality engineers are 10 respondents (10.31%).

Based on the characteristics of the respondent, the qualifications of K1 are 24 respondents (74.74%), K2 qualification are 21 respondents (21.65%), K3 qualification are 18 respondents (18.56%), M1 qualification are 15 respondents (15.46 %), qualification of M2 are 12 respondents (12.37%), and the qualification B1 are 7 respondents (7.22%). The more details the distribution of respondents by the company's qualifications can be seen in Figure 1.

![Figure 1. Percentage of company’s qualification](image-url)
The respondents with 6-8 years’ experience are 45 respondents (46.39%); 3-5 years’ experience are 39 respondents (40.21%); > 8 years’ experience are 12 respondents (12.37%), and 0 -2 years’ experience is 1 respondent (1.03%).

Most respondents had never carried out underestimate costs which are 54 companies (55.67%), and ever carried out underestimate costs which are 43 companies (44.33%).

4.3. The factor causing underestimate cost bidding risk
Based on the contractor answer about the perception, it is shown that the mean of each factors and the ranking based on Table 2.

| Variable | Mean | Rank Level |
|----------|------|------------|
| X₁       | 4.330| 2          |
| X₂       | 4.220| 7          |
| X₃       | 4.240| 6          |
| X₄       | 4.064| 9          |
| X₅       | 4.184| 8          |
| X₆       | 4.310| 3          |
| X₇       | 4.290| 5          |
| X₈       | 4.292| 4          |
| X₉       | 4.374| 1          |

Based on the previous table, the highest mean is contingency cost factor which value is 4.374. It shows that based on the contractor perception, the most dominant factor causing underestimate cost bidding risk in the road construction project in Aceh Province is contingency cost factor.

4.4. Simple correlation analysis (bivariate correlation)
Pearson correlation coefficient analysed using SPSS Version 22 program can be shown in the Table 3.

| Variable | Coefficient | Correlation | Significant |
|----------|-------------|-------------|-------------|
| X₁ – Y   | 0.035       | Very low    | 0.731       |
| X₂ – Y   | 0.009       | Very low    | 0.931       |
| X₃ – Y   | -0.167      | Very low    | 0.101       |
| X₄ – Y   | 0.046       | Very low    | 0.655       |
| X₅ – Y   | -0.180      | Very low    | 0.077       |
| X₆ – Y   | 0.034       | Very low    | 0.742       |
| X₇ – Y   | -0.029      | Very low    | 0.776       |
| X₈ – Y   | 0.007       | Very low    | 0.948       |
| X₉ – Y   | 0.149       | Very low    | 0.144       |

Simple correlation analysis showed that the relationship of underestimate cost offer risk factors to road construction project quality in Aceh Province are quantity take off factor, working method factor, direct cost factor, contingency cost factor, project implementation schedule factor, bidding document review factor, information collection factor, location review factor and indirect cost factor have the very low relationship partially to Pearson correlation coefficient value which is ≤ 0.200.
4.4. Logit regression analysis  
This logit regression analysis is used to predict the possibility of the factors of underestimate cost bidding risk affecting the quality of road construction projects in Aceh Province using the regression equation. This regression analysis has the output of the opportunity through the regression coefficient value, and there is or not the possibility through Wald test. Logit regression analysis showed that most dominant factor of underestimate cost offer risk affecting to good worker both quality and productivity sectors on road construction project quality in Aceh Province is location review factor which regression coefficient value is 3.327. It means that if location review is increased, the workers will improve both the quality and productivity on road construction project quality in Aceh Province.

4.5. Wald test  
Wald test is used to determine whether there is or not the opportunity of underestimate cost bidding risk factors affecting the quality of road construction projects in Aceh Province partially. The Wald Test criteria is when the significance is < 0.05 means underestimate cost bidding risk factors affecting the quality of road construction project partially, otherwise if the significance is > 0.05 means underestimate cost bidding risk factors is not affecting the quality of road construction project partially. The Wald test results obtained from logit regression for each of factor is summarized in Table 4.

| No. | Influence between | Sig.  | Information  |
|-----|-------------------|-------|--------------|
| 1   | X – Y.1           |       |              |
|     | X1 – Y.1          | 0.025 | Take effect  |
|     | X2 – Y.1          | 0.386 | No effect    |
|     | X3 – Y.1          | 0.059 | No effect    |
|     | X4 – Y.1          | 0.031 | Take effect  |
|     | X5 – Y.1          | 0.031 | Take effect  |
|     | X6 – Y.1          | 0.253 | No effect    |
|     | X7 – Y.1          | 0.135 | No effect    |
|     | X8 – Y.1          | 0.892 | No effect    |
|     | X9 – Y.1          | 0.003 | Take effect  |
| 2   | X – Y.2           |       |              |
|     | X1 – Y.2          | 0.045 | Take effect  |
|     | X2 – Y.2          | 0.020 | Take effect  |
|     | X3 – Y.2          | 0.002 | Take effect  |
|     | X4 – Y.2          | 0.001 | Take effect  |
|     | X5 – Y.2          | 0.050 | Take effect  |
|     | X6 – Y.2          | 0.103 | No effect    |
|     | X7 – Y.2          | 0.010 | Take effect  |
|     | X8 – Y.2          | 0.280 | No effect    |
|     | X9 – Y.2          | 0.001 | Take effect  |
| 3   | X – Y.3           |       |              |
|     | X1 – Y.3          | 0.410 | No effect    |
|     | X2 – Y.3          | 0.350 | No effect    |
|     | X3 – Y.3          | 0.103 | No effect    |
|     | X4 – Y.3          | 0.919 | No effect    |
|     | X5 – Y.3          | 0.282 | No effect    |
|     | X6 – Y.3          | 0.028 | Take effect  |
|     | X7 – Y.3          | 0.971 | No effect    |
|     | X8 – Y.3          | 0.856 | No effect    |
|     | X9 – Y.3          | 0.460 | No effect    |
5. Conclusion

5.1. The dominant factors of underestimate cost bidding risk
Through descriptive analysis identified obtained that the highest mean value is contingency cost factor which mean is 4.374. It means that the most dominant factors of underestimate cost bidding risk based on the contractor perception in road construction project in Aceh Province is contingency cost factor. The same study result is also mentioned by the owner represented by Budget Authority (KPA) of road construction that the most dominant factor of underestimate cost bidding risk in the road construction project in Aceh Province is contingency cost factor. The under estimate cost offering generally happen because the contractors do not carefully calculate the contingency cost. The contingency cost is calculated based on the identification of contract risk. The amount of risk cost must be calculated using the correct assumptions, the mistake in estimating the risk cost will impact the lacking of bidding cost occurrence, the risk cost should be given to the condition which possibility can happen and there must be the appropriate reason for the allocation of the risk cost.

From research conducted by Henderson (2009) showed that the most dominant factor of underestimate cost bidding risk in the road and bridge construction project in DKI Jakarta Province is the material is less than the required, the quality does not match the specifications, and the number of equipment are inadequate.

The research conducted by Riyanta (2010) showed that the risk indicator of the underestimate cost and overestimate in the bidding process viewed from the cost engineer competence in the construction service company is using the bad database and information, the weakness in the work methods selection, and the difficulties in getting specialist subcontractor prices.

The research conducted by Hamdani (2014) showed that the dominant risk indicator which impact the quality performance of road construction project in West Sumatra Province is the material is less than the required, the quality does not match the specifications, and the number of equipment is inadequate.

5.2. The correlation of underestimate cost bidding risk factors to the road construction project quality
The correlation between underestimate cost bidding risk factors and the road construction project quality have been analysed through simple correlation analysis. Based on Pearson correlation coefficient values analysed, it shows that all underestimate cost bidding risk factors have the low correlation to the road construction project quality in Aceh Province.

Overall, the simple correlation analysis shows that the quantity take off factor, work method factor, direct cost factor, contingency cost factor, project implementation schedule factor, tender document review factor, collecting information factor, location review factor, and indirect cost factor have very
low correlation partially with Pearson correlation coefficient values is < 0.200 to the quality of road construction projects in the Aceh Province.

From the interview carried out with the owner represented by Budget Authority (KPA) of road construction is obtained that all underestimate cost bidding risk factors observed in this study have a strong correlation to the quality of road infrastructure projects in the Aceh Province.

5.3. The effect of underestimate cost bidding risk factors to the road construction project quality

The effects of the underestimate cost bidding risk factors to the road construction project quality have been analysed by logit regression analysis. The logit regression analysis has the output of the opportunity through regression coefficient value, and there is or not opportunity through Wald test.

Overall, this logit regression analysis showed that from all factors which have the highest regression coefficients is obtained on the location review factor which value is 3.327. It means that from the underestimate cost bidding risk factors which have the highest opportunity of the workers both quality and productivity in the road construction projects in the Aceh Province is location review factor.

The similar results is also founded out from interviews carried out with the owner represented by Budget Authority (KPA) of road construction mentioning that the underestimate cost bidding risk factors which have the highest opportunity to affect road construction project quality in Aceh Province is location review factor. The location review is very important to be done to collect all information relating to the method of the road construction implementation in Aceh Province of Aceh and can estimate the cost required to prepare the bidding.

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