Risk impact on cost and time from the factors of contractor’s managerial and operational

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Abstract. Aceh Province over the last 20 years has experienced different events that can be divided into 3 (three) phases. 1st Phase is the phase of the conflict (2000-2004), 2nd Phase is the post-earthquake and tsunami rehabilitation and reconstruction phase of Aceh (2005-2009), and 3rd Phase is the post-rehabilitation and reconstruction phase (2010-present). Events that occurred during the last 20 years are certainly likely to provide risks to community activities in the province of Aceh. One of the activities affected by the event is the construction project work. The implementation of construction works affected by events in Aceh Province over the last 20 years is highly vulnerable to risks that impact on achieving project objectives such as cost and time. This study analyzes the impact of the contractor and operational managerial risk factors on the cost and timing of construction. Data were obtained from questionnaires distributed to 15 large qualification companies in Aceh Province. Testing data is done by using the validity test and reliability test. Data that has been valid and reliable then analyzed by using Severity Index (SI). The variables of a managerial risk factor with SI to the highest cost in 1st Phase are F5 (incompetent Engineer), 2nd Phase is F3 (lack of contractor experience), and 3rd Phase is F5 (incompetent Engineer). From the operational risk factor, the highest cost SI in each phase is the G3 variable (electrical disorder). The managerial risk factors with the highest time SI in 1st Phase are F6 (lack of top management support), 2nd Phase is F5 (incompetent engineer), and in 3rd Phase is F3 (lack of contractor experience). From the operational risk factor, the highest time SI at each phase is G3 (electrical disorder).

1. Introduction
The construction project is a series of complex, non-routine activities, limited by time, budget, resources and carried out according to specifications, with the ultimate goal of cost, time and quality determined [1,2]. To achieve the ultimate goal of the implementation of the work can be influenced by various risk factors, both internal and external. Internal factors are factors that come from problems in the construction project, whereas external factors are factors that originate from problems outside construction projects which, if they occur, may pose a risk to the project [3,4]. The risk is something that arises from the emergence of these factors which can be either a negative or positive impact [5,6]. Positive impacts will certainly be directly accepted by the construction worker because they will

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contribute to the achievement of the project's objectives, but if the risks that arise cause negative impacts will certainly be avoided because it will disturb targeted results until the failure of the objectives of the project.

In the case of the objective to increase the positive impact and reduce the negative impact of the occurrence of risks to the implementation of construction required construction management [1,2]. Construction management is required to implement the management process effectively and efficiently to achieve the project objectives optimally [1,6,7,8]. From the aspect of risk factors, construction management comes from internal risk factors. The construction management managed by the company's resources is one of the internal factors that greatly affect the success of a company, especially the construction company [9,10,11]. Internal risk factors that directly affect project management include the contractor's managerial and project operations. To analyze the risks from the aspects of construction and operational management will be the different result of analysis because of the happening and felt by the contractor in each implementation area is different.

Construction work in each different work area will experience different risks. This is caused by events or events occurring in each region will have an effect on the occurrence of the risk. Aceh province over the last 20 years has experienced different events that can be divided into 3 (three) phases. 1st Phase is the phase of the conflict (2000-2004), 2nd Phase is the post-earthquake and tsunami rehabilitation and reconstruction phase of Aceh (2005-2009), and 3rd Phase is the post-rehabilitation and reconstruction phase (2010-present). Events that occurred during the last 20 years are certainly likely to provide risks to community activities in the province of Aceh. One of the activities affected by the event is the construction project work. The implementation of construction works affected by events in Aceh Province over the last 20 years is highly vulnerable to risks that impact on achieving project objectives such as cost and time.

Research related to construction project risk in Aceh Province has been conducted related to the assessment of a number of risk factors to the objectives of the construction project in the form of cost, time, and quality. The results are related to project resources [12], external factors [13], managerial and operational factors [14], contracting and design factors [15], and financial factors and methods of construction [16]. To continue the research, this study analyzes the impact of the contractor and operational managerial risk factors on construction cost and time. Data were obtained from questionnaires distributed to 15 large qualification companies in Aceh Province. Testing data is done by using the validity test and reliability test. Data that has been valid and reliable then analyzed by using Severity Index (SI). The variables of a managerial risk factor with SI to the highest cost in 1st Phase are F5 (incompetent Engineer) (0,510 / Medium), 2nd Phase is F3 (lack of contractor experience), and 3rd Phase is F5 (incompetent Engineer). Of the operational risk factors, SI highest cost in each phase is variable G3 (Electrical Disorders). Managerial risk factors with the highest time SI in 1st Phase are F6 (Lack of Top Management Support), 2nd Phase is F5 (incompetent Engineer), and in 3rd Phase is F3 (Lack of Contractor Experience). Of the highest operational risk factor, SI time in each phase is G3 (Electrical Disorders).

2. Research Methods

The research method discusses the methods of data collection, testing of questionnaire instruments, and risk analysis methods to achieve research results.

2.1 Data collection

The data in this study were obtained from questionnaires distributed to large qualification construction companies in Aceh Province. The questionnaire contained a number of questions aimed at obtaining information on the characteristics of respondents and companies, the possibility of risk events, and the impact of risks on the cost and timing of construction implementation of the contractor and operational managerial risk factors felt by construction executors in Aceh Province. Internal risk factors of contractor managerial consists of 9 variables and operational consists of 11 variables, as shown in Table 1.
Table 1. List of managerial and operational risk variables

| Risk Factors        | Code | Variable                                                   |
|---------------------|------|------------------------------------------------------------|
| Managerial          | F1   | Lack of project manager experience                        |
|                     | F2   | Lack of communication and coordination between parties     |
|                     | F3   | involved in the project                                    |
|                     | F4   | Lack of contractor experience                              |
|                     | F5   | Losing data / documents                                    |
|                     | F6   | Incompetent engineer                                       |
|                     | F7   | Lack of top management support                             |
|                     | F8   | Project planning and control is not good                   |
|                     | F9   | Unclear authority, duties, and responsibilities (unclear   |
|                     |      | delegation)                                                |
|                     | F10  | Unregistered project documents                             |
|                     | F11  | Construction work due to difficulty implemented            |
| Operational         | G1   | Lack of supervision of subcontractors and suppliers        |
|                     | G2   | Lack of supervision of the work execution schedule         |
|                     | G3   | Electrical disorder                                       |
|                     | G4   | Difficulty to establish temporary facilities               |
|                     | G5   | Number of jobs that are not according to plan              |
|                     | G6   | Changes in construction work due to difficulty implemented |
|                     | G7   | Changes in the performance of suppliers/contractors        |
|                     | G8   | Repairs due to repetitive work                             |
|                     | G9   | Bad location conditions and difficult to reach             |
|                     | G10  | Lack of telecommunication network provision               |
|                     | G11  | Late getting permission to do work                         |

The data collection was conducted by collecting the results of the distribution of questionnaires on 15 companies from a population of 20 large qualification companies that had been involved in the implementation of construction projects in Aceh Province over the last 20 years. Data from the company is obtained from the list of major qualification companies that exist in the Construction Services Development Agency 2016. The position of respondents filler the questionnaire is a minimal company employee with intermediate positions such as director, manager, and senior engineer.

2.2 Testing of instruments
To measure the accuracy and determination of respondents in providing answers in the research instrument is done testing the perception of respondents. The respondent’s perception test is done to know the validity (accuracy) and reliability (determination) of research instrument before the data in use. The instruments used hereinafter in this study are those that have met the valid and reliable criteria, based on the results of validity and reliability tests that have been done.

2.2.1 Instrument validity test
Validity is the level of validity of the measuring instrument used. The instrument is said to be valid indicating the measuring instrument used to obtain the data is valid or can be used to measure what should be measured [17]. The validity of the questionnaire is measured by calculating the correlation between the data on each statement with the total score using the product moment correlation formula (Equation 1). To specify a valid item or not use the following criteria:

1. If $t_{count} > t_{sig}$, then the question item is valid.
2. If $t_{count} < t_{sig}$, then the question item is invalid.
To obtain $t_{count}$ value used the formula as follows:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$  \hspace{1cm} (1)

$$t_{count} = \frac{\sqrt{n-2}}{\sqrt{1-r^2}}$$  \hspace{1cm} (2)

With $r_{xy} = \text{correlation coefficient}$, $\Sigma x = \text{total item score}$, $\Sigma y = \text{total total score}$ and $n = \text{number of respondents}$.

To obtain a $t_{sig}$ value is to determine the desired significance level. In this case, a significant level is taken at 5%. Significant means convincing or meaningful. In this study significant meaning that the proven hypothesis in the sample can be applied to the population. If it is not significant, then the conclusions of the sample cannot apply to the population (no generalization) or apply only to the sample only. A significant level of 5% or 0.05 means taking the wrong risk in making a decision to reject the wrong hypothesis as much as 5% and correct in making a decision at least 95% (trust level).

To obtain the $t_{sig}$ value required product moment values as shown in Table 2. From the product moment values can be concluded that the $t_{sig}$ value taken in this study is $t_{sig} > 0.514$ because the number of respondents in the study there are 15 respondents ($n = 15$) with a significant level of 5%. Therefore, the Instrument item is considered valid by comparing it with $t_{sig}$, therefore if $t_{count} \geq 0.514$ then the instrument is deemed valid.

### Table 2. Product moment values

|   | Significant Level |   | Significant Level |   | Significant Level |   |
|---|-------------------|---|-------------------|---|-------------------|---|
|   | 5%                | 1% | 5%                | 1% | 5%                | 1% |
| 3 | 0.997             | 0.999 | 27 | 0.381             | 0.487 | 55 | 0.266             | 0.345 |
| 4 | 0.950             | 0.990 | 28 | 0.374             | 0.478 | 60 | 0.254             | 0.330 |
| 5 | 0.878             | 0.959 | 29 | 0.367             | 0.470 | 65 | 0.244             | 0.317 |
| 6 | 0.811             | 0.917 | 30 | 0.361             | 0.463 | 70 | 0.235             | 0.306 |
| 7 | 0.754             | 0.874 | 31 | 0.355             | 0.456 | 75 | 0.227             | 0.296 |
| 8 | 0.707             | 0.834 | 32 | 0.349             | 0.449 | 80 | 0.220             | 0.286 |
| 9 | 0.666             | 0.798 | 33 | 0.344             | 0.442 | 85 | 0.213             | 0.278 |
| 10| 0.632             | 0.765 | 34 | 0.339             | 0.436 | 90 | 0.207             | 0.270 |
| 11| 0.602             | 0.735 | 35 | 0.334             | 0.430 | 95 | 0.202             | 0.263 |
| 12| 0.576             | 0.708 | 36 | 0.329             | 0.424 | 10 | 0.195             | 0.256 |
| 13| 0.553             | 0.684 | 37 | 0.325             | 0.418 | 12 | 0.176             | 0.230 |
| 14| 0.532             | 0.661 | 38 | 0.320             | 0.413 | 15 | 0.159             | 0.210 |
| 15| 0.514             | 0.641 | 39 | 0.316             | 0.408 | 17 | 0.148             | 0.194 |
| 16| 0.497             | 0.623 | 40 | 0.312             | 0.403 | 20 | 0.138             | 0.181 |
| 17| 0.482             | 0.606 | 41 | 0.308             | 0.398 | 30 | 0.113             | 0.148 |
| 18| 0.468             | 0.590 | 42 | 0.304             | 0.393 | 40 | 0.098             | 0.128 |
| 19| 0.456             | 0.575 | 43 | 0.301             | 0.389 | 50 | 0.088             | 0.115 |
| 20| 0.444             | 0.561 | 44 | 0.297             | 0.384 | 60 | 0.080             | 0.105 |
| 21| 0.433             | 0.549 | 45 | 0.294             | 0.380 | 70 | 0.074             | 0.097 |
| 22| 0.423             | 0.537 | 46 | 0.291             | 0.376 | 80 | 0.070             | 0.091 |
| 23| 0.413             | 0.526 | 47 | 0.288             | 0.372 | 90 | 0.065             | 0.086 |
### Table 2. Product moment values

| $n$ | Significant Level 5% | Significant Level 1% | $n$ | Significant Level 5% | Significant Level 1% | $n$ | Significant Level 5% | Significant Level 1% |
|-----|----------------------|----------------------|-----|----------------------|----------------------|-----|----------------------|----------------------|
| 24  | 0.404                | 0.515                | 48  | 0.284                | 0.368                | 1000| 0.062                | 0.081                |
| 25  | 0.396                | 0.505                | 49  | 0.281                | 0.364                |
| 26  | 0.388                | 0.496                | 50  | 0.279                | 0.361                |

Source: Sugiyono (2010)

#### 2.2.2 Instrument reliability test

Reliability test is a reliability or consistency of measuring instrument in measuring what to be measured, meaning whenever the measuring instrument is used will give the same result [17]. So that reliability is a stability or consistency of respondents in answering things related to the forms of questions or statements that are the dimensions of a variable and arranged in a form of a questionnaire. Commonly used reliability analysis is Cronbach Alpha (C-Alpha) analysis. The test using the coefficient C-Alpha must be greater or equal to 0.6 is a value that is considered to be able to test whether or not the questionnaire is used. The formulas used are as follows:

$$ r = \frac{k}{(k-1)} \left[ 1 - \frac{\sigma_b^2}{\sigma_1^2} \right] $$

(3)

with $r = $ instrument reliability, $k = $ number of questions, $\sigma_b^2 = $ number of grain variance and $\sigma_1^2 = $ varians total. The formula for calculating grain variance and total variance is:

$$ \sigma_b^2 = \frac{JKi}{n} - \frac{JKs}{n^2} $$

(4)

$$ \sigma_1^2 = \frac{\sum xt^2}{n} - \frac{(\sum xt)^2}{n^2} $$

(5)

with $\sum xt = $ the total number of respondents' answers, $\sum xt^2 = $ squared the total number of respondents' answers, $Jki = $ sum of squares of whole grains and $Jks = $ the sum of the squares of the subject.

#### 2.2.3 Methods of data analysis

The data analysis used is to obtain the result of possible risk occurrence (frequency) and impact of risk (severity). Therefore, the Severity Index (SI) analysis is needed to analyze the possibility of risk occurrence and Severity Index to analyze the impact of risk.

Severity index shows the index of the impact of risk from the emergence of risk factors. For the calculation of severity index analysis use the formula in the following equation [12].

$$ Severity \ Index \ (SI) = \sum_{i=1}^{5} \frac{a_i n_i}{5N} $$

(6)

with $i = $ category index of respond, $a_i = $ weight associated with the value of the $i$-th response, $n_i = $ frequency of impact of respondent $i$ as a percentage of total respondent for each factor and $N = $ total number of respondents. Measurement of severity is done using a Likert scale with criteria shown in Table 3.
3. Results and Discussion

In this section will be presented the results of data processing and data analysis based on research methods. The discussion is directed to the problem of the impact of risks on construction costs and timing of contractor and operational managerial risk factors.

3.1 Characteristics of respondents and companies

Characteristics of data obtained from the distribution of questionnaires divided into two, namely the characteristics of the questionnaire data from the respondents and the characteristics of the questionnaire data from the company. Results of the company characteristic questionnaire. The company experience in the field of construction has more than 15 years of experience, the number of projects ever handled, almost entirely handled projects of more than 10 projects with the dominant project type of road and bridge projects, the average value of projects worked every year more than Rp. 10,000,000,000 - Rp. 50,000,000,000 with the actual project time being completed every year for 6-12 months.

Respondent data obtained from the results of respondents' answers on questions regarding respondents data. Respondent data are grouped on behalf of respondent, position, gender, the age of the respondent, last education, and years of service. Table 5 shows the results of data processing of respondent characteristics. The position of respondents is dominated by the director, male sex, with an average age above 30 years, recent education domination undergraduate (SI) and with average work experience more than 7 years. Based on the results obtained enough reliable respondents to fill out the research questionnaire.

### Table 3. SI scoring criteria and scales

| Qualification | Likert Scale | Assessment Scale |
|---------------|--------------|------------------|
| Very Low      | 1            | 0,000 ≤ SI ≤ 0,125 |
| Low           | 2            | 0,125 < SI ≤ 0,375 |
| Medium        | 3            | 0,375 < SI ≤ 0,625 |
| Haight        | 4            | 0,625 < SI ≤ 0,875 |
| Very Hight    | 5            | 0,875 < SI ≤ 1,000 |

Source: Majid and McCaffer (1997)

### Table 4. Characteristics of respondents

| Characteristics of Respondent | Category of Measurement | Amount | (%) |
|-------------------------------|-------------------------|--------|-----|
| Personel position             | Director                | 5      | 33,3|
|                               | Manager                 | 7      | 46,67|
|                               | Other                   | 3      | 20,00|
| Last education                | SMA                     | 3      | 13,33|
|                               | Diploma                 | 2      | 13,33|
|                               | Bachelor (S1)           | 9      | 60,00|
|                               | Post Graduate (S2/S3)   | 1      | 6,67|
| Working Experience in         | >2-4 years              | 1      | 6,67|
| personnel                     | >4-7 years              | 1      | 6,67|
|                               | >7 years                | 13     | 86,67|
3.2 Instrument test results

Research results were obtained after data collection and data processing. The data obtained in the form of responses of respondents from the questionnaires that have been disseminated. The questionnaire was addressed to 20 respondents which is a large qualified construction service company in Aceh province, but the respondents obtained as many as 15 companies. This happens because the company address listed on the LPJK is not appropriate and there is no reply from the respondents. This chapter describes the results of research in the form of characteristic data, validity test, reliability test, descriptive statistical analysis, Severity Index analysis (SI), and discussion.

3.2.1 Test results validity

Validity test is used to determine whether or not a question item in the questionnaire. This test is performed on each questionnaire statement and the results are compared with $rsig = 0.514$.

| Impact | Code Var. | Value Range $t_{count}$ Per Phase | Information |
|--------|-----------|-----------------------------------|-------------|
|        |           | 1st Phase                         | 2nd Phase   | 3rd Phase   |             |
| Cost   | F1-F9     | 0.530-0.828                       | 0.517-0.768 | 0.578-0.753 | Valid       |
|        | G1-G11    | 0.524-0.884                       | 0.520-0.804 | 0.520-0.861 | Valid       |
| Time   | F1-F9     | 0.518-0.839                       | 0.530-0.797 | 0.515-0.737 | Valid       |
|        | G1-G11    | 0.523-0.889                       | 0.520-0.795 | 0.520-0.726 | Valid       |

Based on Table 5 can be seen all items of the question under study have value $t_{count}$ greater than $rsig$. Thus the validity test on the contractor and operational managerial risk factors with the time phase of the review indicates that the questionnaire data collection in this study is entirely valid so that it can be executed to the next analysis process.

3.2.2 Reliability test results

After doing the validity test the researchers conducted a reliability test that aims to determine the level of reliability of research instruments so that the measuring tool remains consistent when measured at different times. This calculation uses the Cronbach Alpha formula. The value of a variable is said to be reliable if the Cronbach Alpha value exceeds the value of 0.6. Reliability test is done jointly to all questions and the results are compared with the value of 0.6.

| Impact | Risk Factor | Value Range $t_{count}$ Per Phase | Information |
|--------|-------------|-----------------------------------|-------------|
|        |             | 1st Phase                         | 2nd Phase   | 3rd Phase   |             |
| Cost   | Managerial Contractor | 0.77 | 0.76 | 0.82 | Reliable   |
|        | Operational  | 0.82 | 0.86 | 0.85 | Reliable   |
| Time   | Managerial Contractor | 0.79 | 0.80 | 0.92 | Reliable   |
|        | Operational  | 0.80 | 0.82 | 0.87 | Reliable   |

In Table 6 we can see that the reliability test for each variable indicates that the C-Alpha value for all variables of the contractor and operational managerial risk factors in the analyzed data is greater than 0.6. Thus the reliability test on the contractor and operational managerial risk factors with the time phase of the review indicates that the questionnaire data collection in this study is all reliable so that it can be executed to the next analysis process.
3.3 Result of analysis of Severity Index (SI)
From the result of risk impact analysis using $SI$ which has been summarized in Table 7, from contractor managerial risk factors there is no variable with "high" severity scale. The variable with the highest scale for cost and time severity only impacts the risk on a "medium" scale.

The results of the $SI$ analysis on the cost of contractor risk managerial factors in 1st Phase and 2nd Phase of all variables have a "medium" impact scale on construction costs. In 3rd Phase, from 9 (nine) contractor risk managerial variables there are only 2 (two) variables with a low cost "cost" scale of the variables $F9$ and $F8$, while the other variables have a "medium" impact scale on costs. The results of the $SI$ analysis of the time on the contractor's managerial risk factors in 1st Phase and 3rd Phase of the 9 (nine) variables there is only 1 (one) variable with the scale of "low" impact on construction work time is variable $F9$. In 2nd phase all the variables of the contractor's managerial risk factors show the "medium" impact scale over time.

| Var. Code | 1st Phase | 2nd Phase | 3rd Phase |
|-----------|-----------|-----------|-----------|
|           | $SI$ Cost | $SI$ Time | $SI$ Cost | $SI$ Time | $SI$ Cost | $SI$ Time |
| F1        | 0.410/Medium | 0.480/Medium | 0.450/Medium | 0.490/Medium | 0.400/Medium | 0.470/Medium |
| F2        | 0.430/Medium | 0.510/Medium | 0.400/Medium | 0.480/Medium | 0.400/Medium | 0.450/Medium |
| F3        | 0.450/Medium | 0.510/Medium | 0.490/Medium | 0.490/Medium | 0.430/Medium | 0.530/Medium |
| F4        | 0.390/Medium | 0.400/Medium | 0.410/Medium | 0.400/Medium | 0.390/Medium | 0.440/Medium |
| F5        | 0.510/Medium | 0.520/Medium | 0.430/Medium | 0.510/Medium | 0.430/Medium | 0.480/Medium |
| F6        | 0.480/Medium | 0.550/Medium | 0.450/Medium | 0.450/Medium | 0.450/Medium | 0.470/Medium |
| F7        | 0.440/Medium | 0.510/Medium | 0.400/Medium | 0.470/Medium | 0.410/Medium | 0.470/Medium |
| F8        | 0.430/Medium | 0.440/Medium | 0.400/Medium | 0.440/Medium | 0.360/Low | 0.400/Medium |
| F9        | 0.390/Medium | 0.370/Low | 0.400/Medium | 0.430/Medium | 0.370/Low | 0.370/Low |
| G1        | 0.450/Medium | 0.450/Medium | 0.470/Medium | 0.490/Medium | 0.450/Medium | 0.440/Medium |
| G2        | 0.430/Medium | 0.470/Medium | 0.410/Medium | 0.440/Medium | 0.430/Medium | 0.450/Medium |
| G3        | 0.590/Medium | 0.560/Medium | 0.570/Medium | 0.590/Medium | 0.520/Medium | 0.550/Medium |
| G4        | 0.430/Medium | 0.470/Medium | 0.400/Medium | 0.430/Medium | 0.440/Medium | 0.410/Medium |
| G5        | 0.350/Low | 0.390/Medium | 0.360/Low | 0.390/Medium | 0.350/Low | 0.370/Low |
| G6        | 0.400/Medium | 0.370/Low | 0.430/Medium | 0.440/Medium | 0.400/Medium | 0.430/Medium |
| G7        | 0.410/Medium | 0.470/Medium | 0.440/Medium | 0.410/Medium | 0.450/Medium | 0.480/Medium |
| G8        | 0.440/Medium | 0.370/Low | 0.400/Medium | 0.360/Low | 0.400/Medium | 0.410/Medium |
| G9        | 0.510/Medium | 0.510/Medium | 0.470/Medium | 0.470/Medium | 0.440/Medium | 0.410/Medium |
| G10       | 0.370/Low | 0.400/Medium | 0.410/Medium | 0.410/Medium | 0.410/Medium | 0.400/Medium |
| G11       | 0.480/Medium | 0.450/Medium | 0.370/Low | 0.400/Medium | 0.360/Low | 0.370/Medium |

The results of the $SI$ analysis on the cost of operational risk factors in 1st Phase of 11 (eleven) variables are only 2 (two) variables with a "low" impact scale on costs, ie, variables G5 and G10. In 2nd Phase and 3rd Phase, there are 2 (two) variables with a "low" scale ie variables G5 and G11 while all other variables have a "medium" impact scale on construction costs. The results of the $SI$ analysis of the time on the operational risk factor in 1st Phase there are only 2 (two) variables with the "low" impact scale on the construction work time ie the variables G6 and G8. In 2nd phase there is 1 (one) variable with a "low scale" that is G8. In 3rd phase there is only 1 (one) variable with a "low scale" is the variable G5.

From the calculation of $SI$ cost and time that have been summarized in Table 7 for each variable, it shows that in 1st Phase, 2nd Phase, and 3rd Phase the risk value to cost and time tends to decrease from 1st Phase to 3rd Phase. This is because from phase to phase the conditions in Aceh Province are stable enough so that the influence of these risk factors on the cost and time of construction is reduced.
4. Conclusions
The results of this study show the assessment of the impact of risks on costs and time derived from contractor and operational managerial risk factors. Project risk is one of them influenced by the assessment of the impact of risk. From the risk impact assessment using Severity Index (SI) analysis can be known how big the impact caused by the variable of a risk factor to the project target. In this study, the targets of the projects studied are cost and construction time.

Based on the assessment of the impact of risks on construction costs and timing, from contractor and operational managerial risk factors there is no variable with a "high" impact scale on cost and time. The highest severity value is in the "medium" impact scale range of costs and time. Nevertheless, the variables on these risk factors still have a different effect on the cost and timing of the construction in the three phases of the review.

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