The list order of construction risk contract for small-scale construction service in Surabaya, Indonesia using analytical hierarchy process (AHP)

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Abstract. Small-scale construction service providers dominate the construction industry in Indonesia. However, along with Indonesia's economic growth, small-scale construction service providers owner has a chance to expand their business. Based on their experience, small-scale construction service providers have limitations. They cannot take a priority, whereas the risky of the contract construction. This study aims to make a list order of the construction risk based on medium-scale construction service providers. With this study, we want to help share the medium-scale experience to small-scale construction service providers in terms of risk contracts in Indonesia to learn and anticipate it. We conduct risk identification by literature and make list order analyzing using Analytical Hierarchy Process (AHP). AHP method can provide a single and easy-to-understand of unstructured problems. This research indicates that mismatch between the volume of work in the Bill of Quantity and field conditions is the most risk in terms of contract construction. However, the lump sum contract also identified the risky contract based on medium-scale construction service providers.

1. Introduction
There are 109,964 construction service providers in Indonesia, and 90.66% are small-scale construction service providers [1]. The Construction industry in Indonesia plays a crucial role in Indonesia's economic growth [2]. Indonesia's construction industry accounts for 10.5% of the value of Indonesia's Gross Domestic Product and grows 6.2% every year [3]. With the support of this profitable economic growth, small-scale construction service providers should be able to take advantage of this to develop into a broader provider of construction services. A study states that small-scale construction service providers want to be bigger, so small-scale construction service providers must improve their knowledge and skills for the bidding, field management, and business management processes [1]. Therefore, construction contracts as a reference to make a construction that is a part of the bidding and business management process that must be quasi-managed well by small-scale construction service providers [4]. Not only that, but the number of construction disputes that must be resolved by using construction contracts as a reference also makes the construction contract more critical to understand [4]. To understand the contract thoroughly, the first thing to do is know the risks of existing construction contracts. Knowing the risk means that we can know, analyze, and control the risk in each of the company's activities to obtain higher effectiveness and efficiency [5]. However, after knowing the contract risk, Small-scale construction service providers still have to decide their priority
because there are some contract risk factors. In this case, Small-scale construction service providers lack experience.

However, there are a few studies related to contracting risk priority in Indonesia. Adha (2011) researched the building operate transfer (BOT) contract scheme between the government and the private sector [6]. The study results showed that in a contractual relationship, the government as a party to a BOT contract does not have the same position as another party. Whereas in 2013, Lestari examined the comparison of construction contracts in Indonesia with International Construction Contracts. The results showed that the format used both in construction contracts in Indonesia and international construction contracts is comparable. The difference is in the difference between several terms [7]. Therefore, this study aimed to determine the risk order in construction service contracts based on mid-scale service providers' experience in Surabaya by using the Analytical Hierarchy Process (AHP) method. This research intends to cover the gap between Small-scale construction experience to categorized risk contracts in Indonesia. As a result that the Small-scale construction can focus on anticipating the risk of construction contracts in Indonesia. Furthermore, we also analyze which construction contract tends to be a risk in the Indonesian construction industry.

1.1. Literature Review
The Analytic Hierarchy Process (AHP) method is a measurement theory. AHP is used to derive the ratio scale of several paired comparisons that are discrete or continuous. Pair-wise comparisons are obtained through actual measurements as well as relative measurements of the degree of importance; this is a useful method for obtaining a ratio scale of things that were previously difficult to measure, such as opinions, feelings, behaviors, and beliefs that begin with the creation of a hierarchical or network structure of the problem to be studied [8].

The use of the AHP method in this study refers to the advantages of the AHP method, which provides a single, easy-to-understand, flexible model for a wide range of unstructured problems [8]. Also, AHP uses a deductive approach and system in solving complex problems [9]. This method has also been used in various scientific fields such as supplier selection [10], risk assessment on the Toll Road Project [11], resource placement issues, and others [12]. The AHP method used begins by distributing questionnaires to several respondents. Respondents used in this study were medium-scale construction service providers in Surabaya. Surabaya was chosen because Surabaya is the second-largest city in Indonesia, and many construction projects are being carried out here. In 2017 there were 22 shopping centers completed [13].

2. Methods
The research began by distributing questionnaires to medium-scale construction service providers in the city of Surabaya. There were 5 of mid-scale construction service providers interviewed to obtain priority scale. The respondent for each construction service provider is wanted to handle the procurement document. The respondent has a Minimum of two years’ experience and thirty years of a full experience. However, all respondents are graduate from undergraduate school. Subsequently, we collect the construction contract's risk factor to generate the questionnaire form—the risk factors used as a basis for some research that focuses on risk identification in Indonesia. There thirteen factors that are related to the current situation, as shown in Table 1.
Table 1. Risk identification of risk contract in Indonesia based on Suanda (2008) [14]

| No. | Code | Risk Identification                                                                                                                                 |
|-----|------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | K11  | A mismatch between the volume of work in the Bill of Quantity and field conditions                                                                 |
| 2   | K4   | There are different contract between both party                                                                                                        |
| 3   | K7   | Obstruction of the process of handing overwork.                                                                                                         |
| 4   | K10  | The owner of the construction project does not pay the penalty of delay payment                                                                        |
| 5   | K12  | Termination by service owners                                                                                                                             |
| 6   | K1   | Claim proses are complicated or unclear                                                                                                                  |
| 7   | K5   | The construction implementation method is not comparable with the contract purpose                                                                    |
| 9   | K13  | There is a delay in signing the contract                                                                                                                  |
| 9   | K6   | There is unlimited penalty fee on the contract                                                                                                           |
| 10  | K2   | The unbalanced contract between both party                                                                                                               |
| 11  | K8   | Claims of price adjustments because of changes in government regulations are rejected.                                                                    |
| 12  | K3   | Time target on the contract are not reliable                                                                                                             |
| 13  | K9   | The owner of the project cannot afford to finance the project.                                                                                            |

There are 4 AHP principles, namely Decomposition, Comparative Judgment, Synthesis of Priority, and Logical Consistency. The principle of decomposition is the principle of solving a whole problem into a hierarchical form, a decision-making process where each element or element is interconnected. The decision hierarchy structure can be categorized as complete and incomplete. The form of the decomposition structure, namely, the first level is the decision goal (Goal), the second level is the criteria, and the third level is the alternatives [8]. Furthermore, the factors and types of contracts are arranged into a hierarchical form with three levels consisting of:

1. The first level, which is the objective in the form of a risk level construction contract,
2. The second level is risk indication with code K1 - K13 (Table 1), and
3. The last level is an alternative in the form of lump-sum contract, lump-sum - fixed price (joint contract), and fixed-price contracts.

The questionnaire is interview form based. With the result, the expert can easily understand the survey. Afterward, we were processing the questionnaire based on the AHP calculation [9]. Questionnaire data processing by tabulating the respondents' answers and looking for the mean value for each element being compared. Then pair-wise comparisons were performed for each level element. To see the consistency of the respondents, a consistency analysis using

\[
CI = \frac{\lambda_{\text{max}} - n}{n - 1}
\]

Where:
\[CI\] = Consistency ratio
\[\lambda_{\text{max}}\] = Eigenvalue
\[N\] = Matrix ordo

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If the CI value was zero, then the pair-wise comparison matrix was consistent. The limit to the inconsistency that has been set by Saaty [15] is determined by using the Consistency Ratio (CR), which is a comparison of the consistency index with a random index value (RI).

\[ CR = \frac{CI}{RI} \]  

(2)

Where:
CR = Consistency ratio
RI = Random index

According to the Saaty [15], the random value for this case is 13.56. However, If the pair-wise comparison matrix with a CR value is less than 0.1, then the respondent's inconsistency in making decisions is still acceptable, and if not, then the assessment needs to be repeated.

3. Result and Discussion

3.1. Result

Based on 13 indications of risk factors carried out on small projects in Surabaya, the results are in table 2.

| No. | Code | Weight | Rank | No. | Code | Weight | Rank |
|-----|------|--------|------|-----|------|--------|------|
| 1   | K11  | 0.217  | 1    | 8   | K13  | 0.053  | 8    |
| 2   | K4   | 0.159  | 2    | 9   | K6   | 0.047  | 9    |
| 3   | K7   | 0.107  | 3    | 10  | K2   | 0.045  | 10   |
| 4   | K10  | 0.079  | 4    | 11  | K8   | 0.042  | 11   |
| 5   | K12  | 0.064  | 5    | 12  | K3   | 0.040  | 12   |
| 6   | K1   | 0.057  | 6    | 13  | K9   | 0.034  | 13   |
| 7   | K5   | 0.056  | 7    |

Based on 13 indications of risk factors carried out on small projects in Surabaya, the results are in table 2.

Table 2 shows the result of the list order thirteen risk identification based on the AHP method. The result indicates that the medium-scale construction service providers are concerned about their mismatch between the volume of work in the Bill of Quantity and field conditions, and both parties have a different contract. In the third place is the risk of obstruction of the process of handing over work. However, the lowest risk for the medium-scale construction service providers is if the project owner cannot afford to finance the project. The weight of risk rank number one and number two reaches 0.058 points, and the gap between number two and three are 0.052 points. At this time, each factor's big gap indicates that each respondent may have a different opinion due to their experience and conditions. However, from risk rank number six until twelve, the result indicates that the weight is mostly similar. This value is also indicated in this point; the respondent has a little different perception. In other words, each respondent has some opinion that the risk is can categorized as medium-low risk level. Moreover, in Table 3, the risky contract in the medium-scale construction service providers view is lump sum type, following by combining lump sum and fixed price. However, the fixed price is believed as a low-risk contract. The gap point between each contract type is typically significant. The gap between lump sum and contract number two reaches 0.39 points or more than a half weight point. Simultaneously, the gap between contract Lump sum and fixed price and the fixed
price has the same gap range difference. This difference indicates that each respondent has a similar argument.

| No. | Contract Type                  | Weight | Rank |
|-----|--------------------------------|--------|------|
| 1   | Lump-sum                       | 0.64   | 1    |
| 2   | Lump-sum and fixed price        | 0.25   | 2    |
| 3   | Fixed Price                     | 0.11   | 3    |

3.2. Discussion

Analytical Hierarchy Process (AHP) is a method of handling complex and unstructured problems arranged in the form of a hierarchy [8], with a rating scale of 1 to 9. AHP is used to determine the priority of several criteria using pair-wise comparative analysis of each criterion up to calculating the Consistency Index (CI) and Consistency Ratio (CR). In order to make decisions, it is essential to know how right the consistency is with the consistency criterion of 10%, then the calculation results are declared correct, and it can be interpreted that the respondent is consistent.

A mismatch between the contract volume with the conditions on the ground is a risk that is considered the riskiest by medium-scale construction service providers in Surabaya. This is in line with some of Diekman's studies that state discrepancies in field conditions accounted for 15% of total dispute resolution cases. Also, 6 of the 13 existing risks lead to contract dispute resolution. Therefore, small-scale construction service providers must be prepared with preventive measures if there is a mismatch between the volume of work in the field and the construction contract or other risks that lead to a construction contract dispute settlement. Poerdyatmono concluded that if there is a dispute in the construction industry, then five things can be done. Namely through the channels of consultation, negotiation, mediation, conciliation, a legal opinion by the arbitration agency, or a combination of the five channels by the level of need [16]. In the field implementation, the settlement of construction service disputes is often carried out in consultation, negotiation, mediation, and conciliation, while institutional arbitration and through the court are avoided as far as possible. Therefore, in anticipating disputes, small scale construction service providers must have good mediation skills. This mediation function can be carried out by appointing or seeking a good negotiator. The purpose of a mediator's involvement in the negotiation process is to help the parties to the dispute in the negotiation process so that the dispute can be resolved [17]. Argues that the mediator's role is to help the parties find the problems that arise in their dispute and then understand the difference between their wants and needs and the desires and needs of the other party. That is when deciding to make an offer. In other words, small scale service providers should anticipate the risks of a contract by appointing or providing a Reliable negotiator.

The type of lump-sum contract is also considered to be the riskiest contract. In line with Presidential Regulation No. 16 of 2018 [18] concerning which states that the providers of goods/services entirely bear all risks. In another sense, if a small scale construction service provider takes a contract with the type of lump sum, then all risks must be prepared by them. Indeed, this will be very difficult for small scale construction service providers. Then, the alternative can be done to transfer the risk to another party. In developed countries like China, the transfer of construction risk through insurance is commonly used. In Indonesia, the use of insurance is the awareness of the company [19]. This situation makes small-scale construction service providers have the choice not to use this. However, small-scale construction service providers have to realize the importance of construction insurance to prevent losses. The owner of the project might mention construction insurance in the contract. This set-up might be beneficial for two parties. In small-scale construction service providers' view, they will feel secure if they have some problem with the project. On the other hand, the owner also felt secure if there any problem; construction service providers are still capable
of continuing the project due to the insurance’s assistance. However, this suggestion might have a limitation. Mention insurance in the contract might increase the cost. It also contradicts the lump sum definition that all risks must accept by the construction service providers [18]. In this situation, as the regulator, the government has initiated the new regulation to accommodate both parties and the benefits of the insurance.

4. Conclusion
This research aims to share the experience of medium-scale construction service providers in Surabaya in terms of construction contract risk for small-scale construction service providers. We make ranking for each risk identification using AHP and nominated the high-risk level for each factor. The result indicates that a mismatch between the volume of work in the Bill of Quantity and field conditions is the highest level, followed by any different contract between both parties. For the type of contract, lump-sum was indicated as the high-risk contract. However, for the anticipate of contract construction, small-scale construction service providers should have good negotiators to help the parties to the dispute in the negotiation process so that the dispute can be resolved in terms of the type, the risk of construction contract type. The Indonesian government has to initiated new regulations to accommodate both parties and the benefits of the insurance. Moreover, we need a review of the beneficial insurances for future research in terms of reducing the risk of contract construction in Indonesia.

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