Analysis on construction services laws for civil engineering projects on building failures

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Abstract. Construction Services Laws are legislation used to govern all manners of construction services. This research was taken in Jakarta, Indonesia. Laws used in this research are Law Number 18 of 1999 about Construction Services and Law Number 2 of 2017 about Construction Services. With the shift of Construction Services Law, of course there are several differences, changes, revision, and inclusion and exclusion of past laws. This changes and differences were analysed to improve the current running Construction Services Law for the future. This research uses two methods, which are literature study and study using questionnaire through observations and interviews. Variables and questions for the questionnaire were formed from study of literature, past researches and Construction Services Laws discussed in this paper. Results from the questionnaire was analysed using a computer program, IBM SPSS Statistics 23. Using that program, the data from the results were tested for its validity and reliability. And it was analysed using correlation analysis and factor analysis. From the analysis it was concluded that there are two factors that needs to be improved, the two factors are: regulation about building failure is not explained well enough, and the lack of regulation about Expert Assessor. Through these results, the construction services law can be improved and prevent environmental health damage caused by building failure that was caused by problems in construction services. These environmental health damage caused by building failure have negative impact to environmental health and safety of the surrounding area, whether from emission or toxic pollutants.

Keywords: building failure, construction services law, environmental impact, factor analysis, Indonesia, questionnaire

1. Introduction
According to Law Number 12 of 2011 about the establishment of legislation, the law is "Legislation Regulated by the House of Representatives with the joint agreement of the President." Two legislations that is discussed in this paper are Law Number 18 of 1999 about Construction Services and Law Number 2 of 2017 about Construction Services. There are several past researches used as reference in doing the research on this paper. These researches are about the potential of problem that slows down the continuation of construction [1], research of an analysis on building failure using Law Number 2017 [2], and a research of factor analysis on contract deviation on construction contract by construction service users [3].
Several limitations taken for this research are: the legislation used for this research are Law Number 18 of 1999 about Construction Services and Law Number 2 of 2017 about Construction Services and other construction laws applied in Jakarta, with respondents and experts used for the questionnaire are people who work in civil engineering department or other departments that is relevant in this research.

The purpose of this research is to see whether or not there are any environmental health impact on the factors that caused respondents to say that the Construction Services Law is not fit yet to be a guide for civil engineering workers. This paper is also a continuation of a previous research by the author [4].

2. Methods
There are three types of design for research methods, they are: qualitative, quantitative, and a combination of both. The difference between the two methods lies in: qualitative method uses literature and analysis by writing, quantitative uses numbers and closed questions (quantitative hypothesis) instead of an open question (qualitative interview questions) [5]. Through a method of determination, the method for this research is survey and analysis [6]. The survey is done through questionnaire, with 60 respondents that work in the field of construction and civil engineering, and adequate education (at least university graduate) and work experience of at least 4 years. The minimum limit of respondents in this type of questionnaire (correlation between variable X and Y) is 30, meaning 60 respondents is enough to produce reliable results [7] (if the variables pass the reliability test). The answers from the questionnaire were the data for this research. The data was analysed using IBM SPSS 23. Using that program, the data was be tested for its validity and reliability and was analysed in correlation and factor analysis.

3. Results and Analysis
Before distributing the questionnaire to the 60 respondents, the questionnaire was distributed to several respondents as a pilot sample to see the validity and reliability of the questions and variables [17]. This pilot sample will allow the questionnaire to be updated, changed, and improved upon if needed. The results of this pilot sample show that the Cronbach’s alpha score is more than 0.8, meaning the questions and variable of the questionnaire is reliable. When tested for its validity, there are two eliminated independent variables. The research continues by distributing the questionnaire to the rest of the respondents. After the answers of the questionnaire have been analysed using factor analysis, the analysis on environmental health impact (in this case, it is building failure) based on the results of the questionnaire can be taken.

3.1. Questionnaire
The construction of the questionnaire for this research is based on several past researches and through literature study. The questionnaire was made by adapting questions from past researches as a basis of independent variable (variable X). Questions variable that was made from adapting past researches was created by looking at the differences between Law Number 18 of 1999 and Law Number 2 of 2017. There are 20 variable X (independent variable), with Y variable (Dependent Variable) is “Law/Act About Construction Services has not met the criteria needed to be a guide for construction service providers and users”. Questionnaire in this research used the Likert scale with five stage/category, although there are several researchers who used seven to nine stage [8].

3.2. Validity Test
The Spearman – Brown equation is used to calculate the validity of a survey in ordinal scale with the help of IBM SPSS 23. For the data to be valid, the result must be higher than 0.214, this number was taken from the table Upper Critical Values of Spearman’s Rank Correlation Coefficient Rs [9][10]. The result shows that all variable has a value of over 0.214, meaning that all variable is valid and so is the questionnaire, this is also interpreted as the questionnaire can measure the results from the survey.
3.3. Reliability Test
One of the measurements of reliability test of a questionnaire is a variable indicator and a reliability instrument known as Cronbach’s alpha [11]. After the test, the data shows a reliability score of 0.888, according to the reliability values table, the value of 0.888 means that it falls into the category of “Very Good” [12].

3.4. Correlation Analysis
The correlation analysis used Pearson correlation to find the relation between variable [13]. Before correlation test can be taken, the ordinal data from questionnaire must be converted into interval data using method of successive interval, using the help of Ms Excel. Refer to table 1 for the result of Correlation test.

| Table 1 Results of Pearson Correlation |
|----------------------------------------|
|                                         |
| Y                                      |
| Pearson Correlation                     | .275 | .313 | .287 | .305 |
| Sig. (2-tailed)                         | .034 | .015 | .026 | .018 |
| N                                      | 60   | 60   | 60   | 60   |

| a. Laws about building failure is not explained well |
| b. Not enough laws and regulation about the choosing of expert appraiser |
| c. Not enough regulation that govern over the standard of Construction Work Force |
| d. Uncertainty on rules about the sanction/ fines (if problem occurred) for the parties involved in construction services |

Based on the results, the dependent variable (variable Y) has a significant correlation to 4 independent variables (variable X). These independent variables were chosen based on the significance of 0.05 and 0.01. The stronger the relationship of the correlation then the value of Pearson correlation will be bigger as well, the stronger the correlation then the value of significance will be lower. The test result shows that independent variable X13 has the highest Pearson correlation with the value of 0.313 and significance of 0.15.

Correlation between independent variable (Variable X) was also tested before factor analysis can be started. The correlation relationship between independent variable (Variable X) must be checked for because one of the requirements for factor analysis is there must be strong correlation between independent variable (Variable X), with the results shows that there is relationship between the variables with the highest correlation value is 0.540 and the significance is 0.01.

3.5. Factor Analysis
Because this research has more than two variables, the factor analysis is used to see the values of communalities of each variable and determining the significance of its contribution from each variable to the resulting factor. The analysis is using matrix component for the reduction of variables (process of elimination). This analysis also used varimax rotation to maximize the variance to get a significant loading value for each formed factor

The table below shows the value of KMO MSA (Kaiser-Meyer-Olkin Measure of Sampling Adequacy) is 0.640 which is higher than 0.5, meaning the research can continue.

| Table 2 Results of KMO and Bartlett’s Test |
|-------------------------------------------|
|                                          |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | .640 |
| Bartlett's Test of Sphericity             |
| Approx. Chi-Square                       | 35.941 |
| df                                        | 6      |
| Sig.                                      | .000   |
To see the correlation between independent variable, see table below, with the MSA value must be higher than 0.5 for the analysis to continue. The table below shows there aren’t any value of MSA below 0.5. The value that determined this are values with superscript “a”. The value higher than 0.5 meaning the variables can be predicted and analysis can continue.

| Table 3 Anti Image Matrices |
|-----------------------------|
|                             |
| x12 | x13 | x14 | x19 |  |
| X12 | .685 | -325 | -.102 | -.055 |
| X13 | -.325 | .672 | -.158 | .004 |
| X14 | -.102 | -.158 | .778 | -.240 |
| X19 | -.055 | .004 | -.240 | .884 |

| Anti-image Covariance |
|-----------------------|
| X12 | X13 | X14 | X19 |  |
| X12 | .627a | -.480 | -.140 | -.071 |
| X13 | -.480 | .613a | -.219 | .005 |
| X14 | -.140 | -.219 | .694a | -.290 |
| X19 | -.071 | .005 | -.290 | .648a |

a. Measures of Sampling Adequacy (MSA)

The communalities of each factors/variables can be seen below. These communalities are used to explain how much each of the variable is capable to explain a factor.

| Table 4 Communalities of Each Factors |
|---------------------------------------|
|                                      |
| x12 | x13 | x14 | x19 |  |
| Initial | Extraction |
| X12 | 1.000 | .591 |
| X13 | 1.000 | .599 |
| X14 | 1.000 | .517 |
| X19 | 1.000 | .257 |

Based on the value of extraction from each variable, it can be concluded that the highest value is X13 = 59.9%, meaning that insufficient rules that governs over the choosing of expert appraiser when a problem occurred when a building failure happens is the biggest factor to the dependent variable (variable Y), and the second highest is X12, which are Laws about building failure is not explained well enough. Two out of four factors are about building failure. That is why further insight and research can and must be done to explain this occurrence.

3.6. Analysis on Building Failure

According to Government Regulations Number 29 of 2000 article 34, building failure is a non-functional building, in a whole or a part of it, from the technical, use, health and safety, and/ or general safety perspective, caused by the failure of construction services provider or user/ owner after the final handover of construction works. From a previous research, it is said that in the context of building construction project, construction and building failure happens mostly on the building structure element, with deviations lies in the contract value, roof construction, foundation, utility, and the last is finishing. One indication of the causes of construction and building failures is the contract value that is less than 70% of the value of the budget allocation determined for spending. This difference between the value of the contract can potentially disturb the process of construction and the technical specification of the project was not met [14]. Based on past researches, it was concluded that building failure can have serious consequences to the environment. It can have consequences for plants, animals, and humans. One of its pollution is CO2 emission. The amount of CO2 emission comes from the repair phase of a building structure, and an increase of CO2 emission due to the loss of
functionality. There is also embedded carbon in concrete and reinforced concrete as a result of the cement manufacturing process. In rare cases, a release of toxic pollutants may have serious consequences of a building failure (collapse), these toxic pollutants will pose danger for the environment. Unfortunately, a current difficulty in developing and validating techniques to calculate the consequence of a building failure is the lack of case studies with detailed information [15]. Expert assessment of a building failure or construction failure can have a large impact, because it can be subjected to criminal offenses, if it is not handled by someone who has the required competence, it could lead to more problem in the future for both parties. These competences are in accordance to the expertise of a certain field, with evidence in the form of a Certificate of Expertise issued by Construction Services Development Agency with the assessor name registered as an expertise in a certain field [16].

4. Conclusion
Based on the data and analysis, it can be concluded that within the current Construction Services Law, there are 4 (four) factor that makes services users and providers felt that the Construction Services Law is not adequate to be a guideline. Those 4 (four) factors are: laws about building failure, regulation about the selection of expert appraiser in the case of building failure, the standard for the construction work force is not regulated enough, and uncertainty about the sanctions/ fines for the parties involved in construction services. From those four, two of them involved building failure. Building failure in building construction project happens mostly on the building structure element, with deviation lies on: the contract value, roof construction, foundation, utility, and finishing. Construction and building failure can have environmental damage, especially if there are any toxic pollutants involved in the building failure. Therefore, to keep and manage environmental safety, construction and building failure must be avoided at all cost. Several improvements that can be taken for the future of construction services laws are: increase the regulation and laws about the effect of building failure to the environment, and there needs to be a general qualification for expert appraiser in the Construction Services Law to ease the registration of new expert appraiser. An advice for future researches is to increase the research on the impact of building failure to the environment, because based on previous research in 2011, there is a lack of case studies with detailed information in this field.

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