The International Journal Of Engineering And Science (IJES)
|| Volume || 4 || Issue || 4 || Pages || PP.05-10|| 2015 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Alternative Contractual Models of Dredging Projects to Avoid Disputes (A Case Study of the Special Port in Kotabaru)

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ABSTRACT

There had been four dredging projects done at the Special Port of PT. Indocement Tunggal Prakarsa Tbk. in Kotabaru, two of which ended in disputes. Therefore, it is necessary to analyze the causative factors for disputes and selection of the best contractual model for dredging projects to avoid disputes. The method employed was the Analytic Hierarchy Process (AHP). The analysis results in the most significant criteria to avoid disputes in dredging projects, which are technical and quality aspects (43%) and the most significant sub-criteria, which are the factors of fixed designs as well as complete and accurate drawings (75%). The alternative contractual model chosen is the Lump Sum Fixed Price contract (53%), where the importance value given by experts reaches 49%. In so doing, in order that dredging projects do not end in disputes, the best contractual model is the Lump Sum Fixed Price..

Keywords *- Analytic Hierarchy Process, Contract, Disputes, Dredging.*

Date of Submission: 08-April-2015 ⟺ Date of Accepted: 20-April-2015

I. INTRODUCTION

Since 1996 until 2013, there had been four dredging projects carried out in the port basin of PT. Indocement Tunggal Prakarsa Tbk's special port in Kotabaru – South Kalimantan. The dredging was done mainly in the flow of rock and mud areas. Of the four dredging projects, two projects ended in disputes, even one of the cases was taken to court. Dredging projects ended in disputes in 2007 and 2011. Another example of employment contract disputes is the dredging project of Barito river channel, which was taken to court, i.e. the South Jakarta District Court, between PT. Adaro Indonesia Tbk as the owner and PT. Arwibas Trasco as the contractor in charge. As a result of such disputes, the project is postponed and the target channel depth set is not achieved. On the other hand, project leaders, both the owner and the contractor in charge, will have to spend their time attending the sessions in the arbitration or judicial institutions. Thus, it is necessary to analyze the causative factors for disputes and to determine alternatives to avoid disputes as well as to formulate a contractual model for dredging projects.

II. LITERATURE REVIEWS

2.1 The Role of Contracts in Project Management

Considering their highly strategic role in managing projects, professionalism and competence of a project manager or engineer will bring a significant impact on the successful implementation of a project. One of the devices that will greatly assist project managers or engineers in carrying out their duties above is construction employment contracts prepared by the employer and the contractor or the service provider [1].

Construction employment contracts are defined as the entire document that governs the legal relationship between the service user and the service provider in a construction project. The following are contractual models [2]:

1) Fixed Price Contracts, i.e. the total price of the entire work or the price per work unit has been predetermined from the beginning. This type of contract includes Lump Sum Contracts and Unit Price Contracts
2) Prime Cost Contracts, i.e. the owner shall pay the actual cost incurred during the implementation stage, coupled with the fee charged for services provided by the contractor (including administrative costs). This type of contract is divided into Cost Plus Fixed Procentage, Cost Plus Fixed Fee, Cost Plus Variable Percent, Target Estimate and Guaranteed Maximum Cost.

2.2 Dredging

Dredging work can be classified into four types, namely; 1) capital dredging; 2) maintenance dredging; 3) rock dredging; and 4) reclamation. Before initiating dredging work, it is usually necessary to conduct a survey to examine and collect data. The survey may be in hydrography, geotechnics, hydraulics, or meteorology [3]. Models of Dredging Contracts can be categorized as follows:

1) Fixed Lump Sum Price: in this contractual model, the service user and the service provider agree on a fixed amount to be paid by the service user to the service provider for the the entire dredging work in order to reach the predetermined basin depth and area width set forth in the contract.
2) Unit Price: in general, in this contractual model, the volume of dredging materials writen in the contract is an estimate, where the amount of the volume is obtained from the bathymentric mapping calculation before the dredging work is initiated, with the average depth to be achieved. As for the actual dredging volume, it will be recalculated and measured by the service user in conjuction with the service provider to determine the volume of work actually performed.
3) Performance Based Contract: this contractual model is different from the traditional one, in which payment to the service provider is determined based on the accomplished "performance" of the work. Performance-based contracts in dredging work are usually applied to jobs which include maintainning dock, basin and channel depth [4].

2.3 Factors Causing Disputes

It is undeniable that in any construction projects there is a high possibility of disputes to occur. Mitropoulos & Howell (2001) [5] explains that basically there are three root causes of disputes in construction projects, namely: (1) uncertainty in any construction project, (2) issues related to the construction contract, and (3) the opportunistic behavior of the parties involved in construction projects.

Disputes in construction processes can be divided into two, seen from the root causes [6], namely construction-related disputes and human behavior-related disputes. According to Xinhua (2010) [7], there are several key factors which trigger complexity of a construction project, which in turn lead to disputes, namely:

1) Validity of the instruction given by the client or consultant to the contractor.
2) The client or owner misunderstands the delivery or service the contractor has promised them.
3) Weak management capabilities in areas relating to law, and dispute resolution which instead make conflicts last longer.
4) The cultural diversity which leads to poor communication and understanding among the parties entering into the contract.

There are a couple of things which causes disputes, allowing one make a claim [8], namely improper and poor design information, incomplete site investigations, clients' slow response, poor communication, unrealistic deadline, poor contract administration, beyond-control external events, incomplete tender information, unclear risk allocation, delay (delays in payment). Pena-Mora et.al. (2003) [9] simplifies the dispute classification into two, namely organizational issues and the issues of uncertainty.

2.4 The Analytic Hierarchy Process (AHP) Method

The Analytical Hierarchy Process Method is the basis for making a decision, designed and carried out rationally by selecting the best possible alternative evaluated using multiple criteria. In this process, decision-makers ignore minor changes in decision-making processes and further develop any possible priorities to rank them from various alternatives. In the AHP method, decisions are classified into two, i.e. consistent and inconsistent ones [10]. It consists of a number of steps as follows:

1) Defining the problem and determining the expected solution
2) Creating a hierarchical structure that begins with a more general purpose, followed by smaller purposes, criteria and possible alternatives at the lowest level.
3) Making a paired-comparison matrix describing the relative contribution or the influence of each element on each goal or criterion one level above it. Making a paired-comparison to obtain the whole measurement using the formula of $n \times [(n-1)/ 2]$, where *n* refers to the number of elements being compared.
4) Calculating the eigen value and examining its consistency, repeat the data retrieval if it is not consisten
5) Repeating steps 3 to 4 for all levels of hierarchy.
6) Calculating the eigen vectors of each paired-comparison matrix. Eigen vectors are the value for each element.

Check the consistency of the hierarchy, if the value is more than 10 percent, it implies that the data measurement needs to be revised. The AHP measurement method employs two measurement methods, i.e. Relative Measurement Method (RMM) and Absolute Measurement Method (AMM) [11].

Consistency measurement of a matrix is based on a maximum eigen value. The following is the formula to calculate the consistency index:

$$CI = \frac{(\lambda_{maks} - n)}{(n\ - 1)}$$

Where this is the eigen value and n is the matrix value. The maximum Eigen value of a matrix will not be less than the value of n. In so doing, the consistency index (CI) value will never be negative. The closer the maximum eigen value to the the matrix value, it means that the matrix is more consistent and if they are equal, it means that the matrix is either 100% consistent or 0% inconsistent. The consistency index is then converted into the inconsistency ratio by dividing a random index. The random index values are presented in Table 1.

Table 1. Random Index Values [12]

Matrix Value (n)	1	2	3	4	5	6	7	8	9	10
Random Index (RI)	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

The comparison between the consistency index and the ratio index of a matrix is defined as the consistency ratio (CR). For the AHP model, a comparison matrix is accepted if the value of the consistency ratio is less than 0.1.

III. RESEARCH METHODS

The research was conducted in several phases and each phase consists of several stages as can be seen in Fig. 1, and the criteria and sub-criteria variables are presented in Table 2.

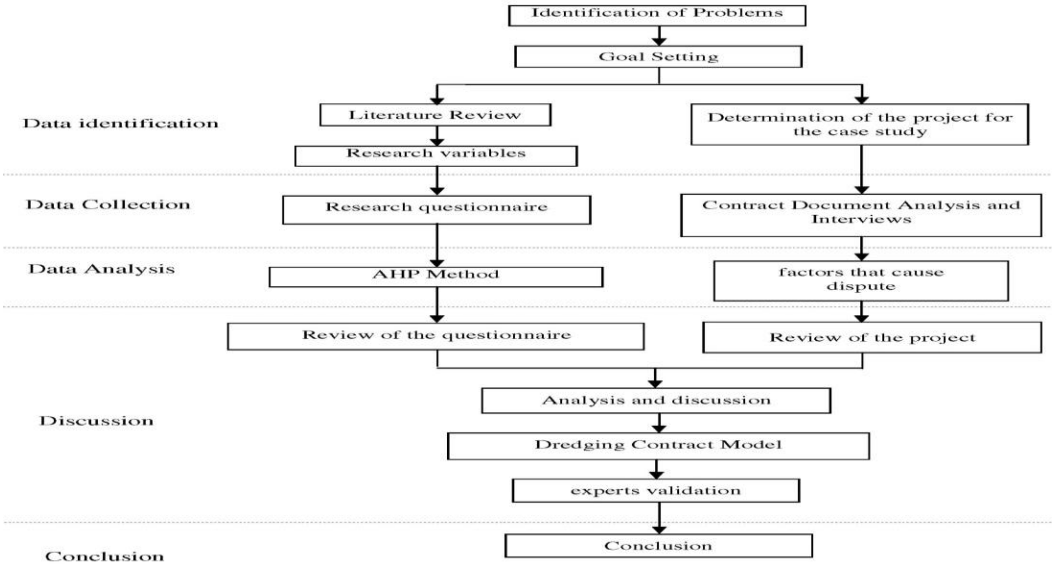

Figure 1. Stages of Research

Table 2. Classification of the Criteria and Sub-criteria Variables of Potential Dispute-Triggering Sources

Code	Factors to Avoid Potential Disputes in Dredging Contracts (Criteria and Sub-criteria)
C_1	The Price Aspects of the Contract
SC_{11}	The factors of the total fixed price and unfeasible price adjustments
SC_{12}	The factor of the fixed volume unit price, with certain technical specifications
SC_{13}	The factors of the fixed price and assessment based on performance and incentives for performance which exceeds the target performance (KPI)
C_2	The Aspect of Payment Methods
SC_{21}	The factor of payment based on the stages of the output product resulted from the contract
SC_{22}	The factor of payment based on the combined measurement results on the volume of the work completed by service providers
SC_{23}	The factor of payment based on the experimental results after the work has been completed whose performance is to be assessed
C_3	The Technical and Quality Aspects
SC_{31}	The factors of fixed designs and complete and accurate drawings
SC_{32}	The factors of unfixed designs, drawings and accuration
SC_{33}	The factors of fixed and integrated designs, implementation, experiments and maintenance
C_4	The Aspect of Risk Allocation
SC_{41}	Risks are incurred solely by service users
SC_{42}	Risks are incurred solely by service providers
SC_{43}	Risks are incurred solely by service users and service providers
C_5	The Time Aspect

SC_{51}	The deadline for the project is tight
SC_{52}	The deadline for the project is less tight
SC_{53}	The deadline for the project is not tight
C_6	The Aspect of Additional or Reduced Work
SC_{61}	Additional or reduced work is allowed
SC_{62}	Additional or reduced work is not allowed

Based on the identification, there are three types of alternatives for the contractual models of dredging projects, namely:

I. Alternative 1 is the Fixed Lump Sum Price Contract (A_1),
II. Alternative 2 is the Unit Price Contract (A_2), and;
III. Alternative 3 is Performance-Based Contract (A_3).

The data were collected by distributing questionnaires to 20 respondents of individuals with experience working as a project manager, field manager, and supervisor of dredging project execution.

IV. DATA ANALYSIS AND RESULT

The results for the comparison of respondents' preferences are presented in the form of a normalized matrix and the consistency ratio, as shown in Table 3. The average consistency measure is the maximum eigen value (λ_{max}), i.e. by 6.49 while the consistency index (CI) value is 0.10. The random index (RI) value is obtained from Table 1, for the matrix value with n = 6, the value of RI is equal to 1.24, so that the consistency ratio (CR) is equal to 0.08.

Table 3. The Normalized Criteria Matrix and the Consistency Ratio

	C_1	C_2	C_3	C_4	C_5	C_6	Total	Average	Consistency Measure
C_1	0,09	0,13	0,12	0,06	0,04	0,18	0,61	0,10	6,36
C_2	0,03	0,04	0,09	0,04	0,02	0,02	0,24	0,04	6,16
C_3	0,34	0,21	0,47	0,58	0,56	0,43	2,58	0,43	6,76
C_4	0,26	0,21	0,16	0,19	0,22	0,18	1,22	0,20	6,72
C_5	0,26	0,29	0,09	0,06	0,11	0,12	0,94	0,16	6,57
C_6	0,03	0,13	0,06	0,06	0,06	0,06	0,40	0,07	6,40
							λ_{max}		6,49
							CI		0,10
							RI		1,24
							CR		0,08

The most important aspect to avoid potential disputes in dredging contracts among all the criteria is criteria C_3, which is technical and quality aspects, with the highest average value of 0.43 or 43%. The value of the consistency ratio (CR) is 0.08, which is smaller than 0.10 (CR <0.10), meaning that respondents' preference is consistent.

3.1 Sub-Criteria-Scoring Matrix

The calculation results of the sub-criteria comparison matrix for all the criteria will generate the priority weights as shown in Table 4.

Table 4. Sub-Criteria Priority Weights for All Criteria

Code	Factors to Avoid Potential Disputes in Dredging Contracts (Criteria and Sub-criteria)	Sub-criteria Weight
C_1	The Price Aspects of the Contract	
SC_{11}	The factors of the total fixed price and unfeasible price adjustments	**0,67**
SC_{12}	The factor of the fixed volume unit price, with certain technical specifications	0,15
SC_{13}	The factors of the fixed price and assessment based on performance and incentives for performance which exceeds the target performance (KPI)	0,18
C_2	The Aspect of Payment Methods	
SC_{21}	The factor of payment based on the stages of the output product resulted from the contract	**0,69**
SC_{22}	The factor of payment based on the combined measurement results on the volume of the work completed by service providers	0,18
SC_{23}	The factor of payment based on the experimental results after the work has been completed whose performance is to be assessed	0,14
C_3	The Technical and Quality Aspects	
SC_{31}	The factors of fixed designs and complete and accurate drawings	**0,75**

SC_{32}	The factors of unfixed designs, drawings and accuration	0,09
SC_{33}	The factors of fixed and integrated designs, implementation, experiments and maintenance	0,16
C_4	The Aspect of Risk Allocation	
SC_{41}	Risks are incurred solely by service users	0,08
SC_{42}	Risks are incurred solely by service providers	0,19
SC_{43}	Risks are incurred solely by service users and service providers	**0,72**
C_5	The Time Aspect	
SC_{51}	The deadline for the project is tight	**0,63**
SC_{52}	The deadline for the project is less tight	0,26
SC_{53}	The deadline for the project is not tight	0,11
C_6	The Aspect of Additional or Reduced Work	
SC_{61}	Additional or reduced work is allowed	**0,90**
SC_{62}	Additional or reduced work is not allowed	0,10

3.2 Alternative Scoring Matrix

Based on the criteria, sub-criteria and alternative scoring, all the average alternative values are multiplied by the sub-criteria values, which in turn generate the alternative contractual model, with the highest value generated from the multiplication, as shown in Table 5.

Table 5. Determination of Alternative Contractual Models to Be Selected

	A_1	A_2	A_3	Sub-criteria Weight (SW)
SC_{11}	0,73	0,07	0,20	0,67
SC_{12}	0,07	0,81	0,12	0,15
SC_{13}	0,09	0,09	0,82	0,18
SC_{21}	0,76	0,08	0,16	0,69
SC_{22}	0,08	0,80	0,12	0,14
SC_{23}	0,09	0,09	0,82	0,18
SC_{31}	0,63	0,07	0,30	0,75
SC_{32}	0,10	0,81	0,09	0,09
SC_{33}	0,09	0,09	0,82	0,16
SC_{41}	0,11	0,79	0,10	0,08
SC_{42}	0,64	0,06	0,30	0,19
SC_{43}	0,11	0,11	0,78	0,72
SC_{51}	0,58	0,06	0,37	0,63
SC_{52}	0,81	0,10	0,09	0,29
SC_{53}	0,76	0,13	0,11	0,11
SC_{61}	0,82	0,09	0,09	0,90
SC_{62}	0,10	0,81	0,09	0,10
ΣA_i x SW	**0,53**	**0,15**	**0,32**	

The alternative contractual model with the highest value is A_1, i.e. the Lump Sum contractual model, with the value of respondents' preference by 0.53 or 53%.

3.3 Results of Expert Validation

The contractual model was validated by distributing questionnaires to experts selected based on the following criteria: experts in construction experienced in the field of dredging for at least 5 years, legal experts or technicians experienced in construction contracts for at least 5 years, and academicians experienced in construction contracts for at least 5 years. The results of the questionnaires as shown in Table 6 shows that the lump sum fixed price contract gains the highest value for the contractual model selection with a total value of 0.49 or 49%.

Table 6. Tabulation Results for the Expert Validation of the Contractual Models

Code	Contractual Model	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	Weight
A_1	Fixed Lump Sum Price	5	5	5	5	4	5	5	5	4	5	0,49
A_2	Unit Price	1	2	1	1	1	2	1	1	2	1	0,13
A_3	Performance Based Contract	5	3	4	3	4	3	3	4	3	5	0,38

V. CONCLUSION

Based on the analysis, the following are the root causes of disputes in dredging projects: 1) incomplete plan drawings or technical specifications, 2) differences in field conditions, 3) unclear risk allocation, 4) inappropriate selection of contractual models, 5) delay in work completion, and 6) additional or reduced work.

The most important criteria to note to avoid disputes in dredging projects is on the technical and quality aspects with an importance value of 43%, with the factors of fixed designs and complete and accurate drawings as the most significant sub-criteria, with a value of 75%. The consistency ratio (CR) value for the criteria is 0.08, smaller than 0.10 (CR <0.10), meaning that the respondents' preference is consistent. The alternative contractual model is Lump Sum Fixed Price, with the impotrance value given by the respondents by 53%. Experts recommend another alternative to the performance-based contractual model, however this contractual model remains unfamiliar in Indonesia and still has no legal umbrella.

ACKNOWLEDGEMENTS

This paper has been realized with the financial support of the Magister Program of Civil Engineering – Engineering Faculty – Lambung Mangkurat University.

REFERENCES

[1] Budhy Manan, *Pemberlakukan Standar Kontrak FIDIC Dalam Hukum Indonesia*, Thesis, University of Indonesia, 2001.
[2] Nazarkhan Yasin, *Mengenal Kontrak Konstruksi di Indonesia* (Jakarta: Gramedia, 2003).
[3] Satya Nugraha, Survey *Hidrografi dan Pelaksanaan Pengerukan Alur Pelayaran Pelabuhan (Studi Kasus : Pelabuhan Tanjung Priok)*, Thesis, University of Indonesia, 2008.
[4] Nazarkhan Yasin, *Tinjauan Standar/Sistem Kontrak Konstruksi International (FIDIC, JCT, AIA, SIA)* (Jakarta: Gramedia, 2004)
[5] Panagiotis Mitropoulos and Gregory Howell, Model for understanding, preventing and resolving project disputes", *Journal of Construction Engineering and Management*, 127(3), 2001, 223-231.
[6] Sai On Cheung and Kenneth T.W. Yiu, . A study of construction mediator tactics-Part I: taxonomies of dispute sources, mediator tactics and medaition outcomes, Building and Environment 42 (2007), 2005, 752-761.
[7] Xinhua He, A Framework of Dispute Avoidance and Resolution of Construction Project Management, *Management and Service Science (MASS), 2010 International Conference on*, Wuhan, 2010, 1-4.
[8] P. Abdulrasyid, *Arbitrase dan Aternatif Penyelesaian Sengketa* (Jakarta: Fikahati Anesta, 2000)
[9] Feniosky Pena-Mora, Carlos E. Sosa, and D. Sean McCone, *Introduction to Construction Dispute Resolution* (NJ: Prentice Hall, 2003)
[10] FA Luky Primantari, *Aplikasi analitical hierarchy process (AHP) pada pemberdayaan landas pacu bandara internasional Adisumarmo Surakarta,* Thesis, University of Sebelas Maret, 2008.
[11] Iphan F. Radam, Agus T. Mulyono, and Bagus H. Setiadji, Typical river transport for Banjarmasin based on the criteria of the National Transportation System. *International Refereed Journal of Engineering and Science (IRJES) , 3* (8), 2014, 28-37.
[12] Thomas L. Saaty, (*Decision Making for Leaders: The Analytical Hierarchy Process for Decisions in Complex World* (Pittsburgh: RWS Publications, 1982)