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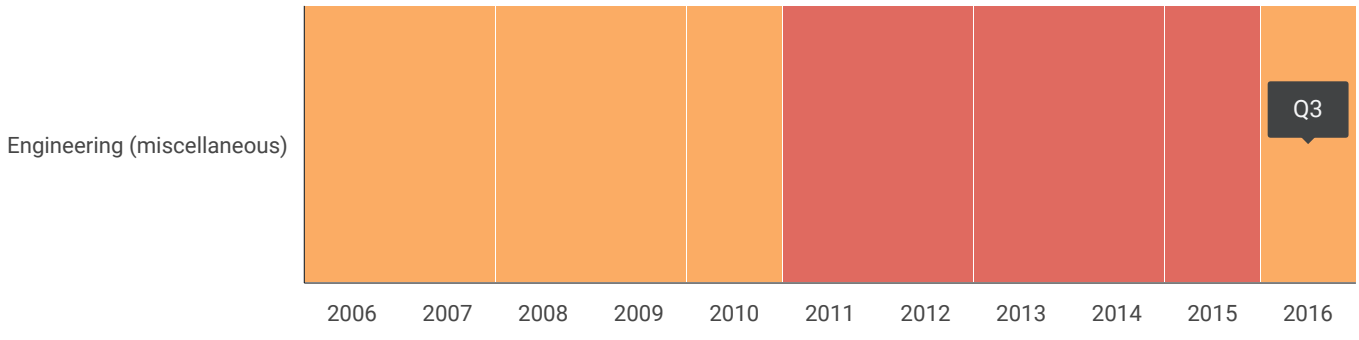

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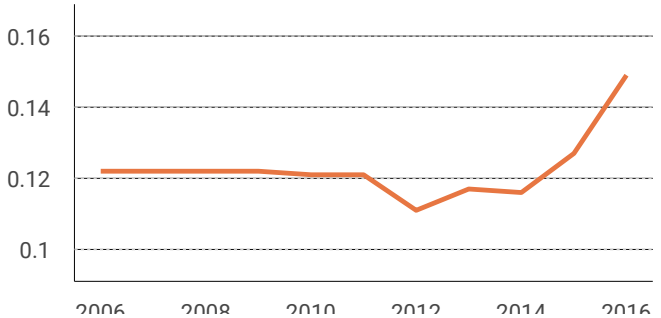

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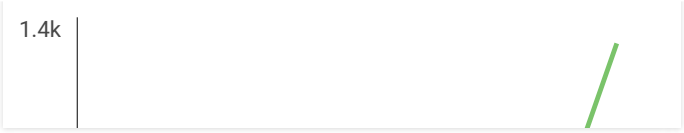

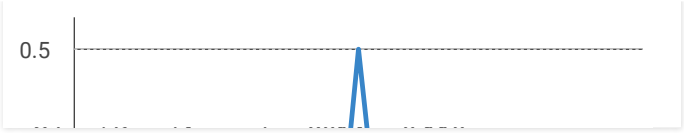

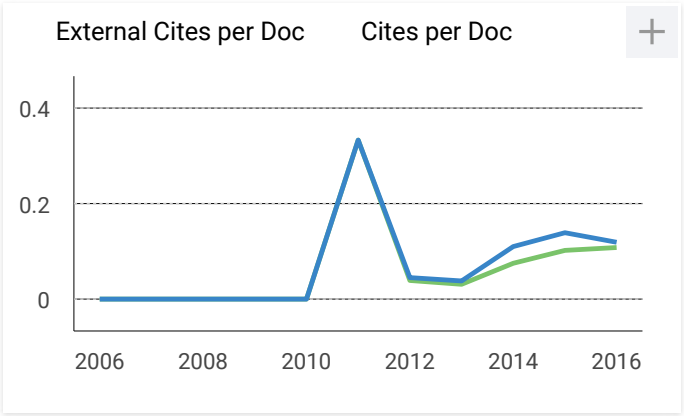

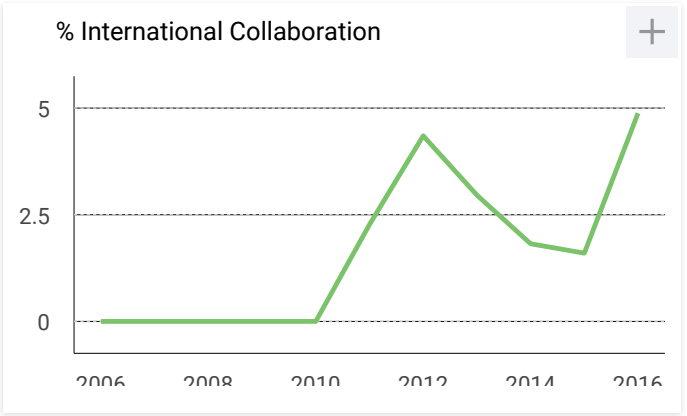

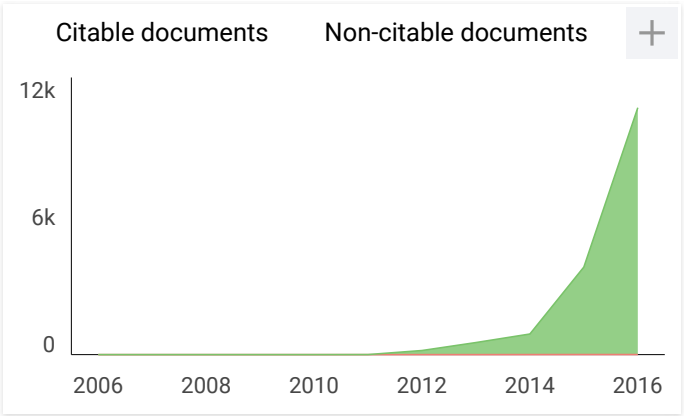

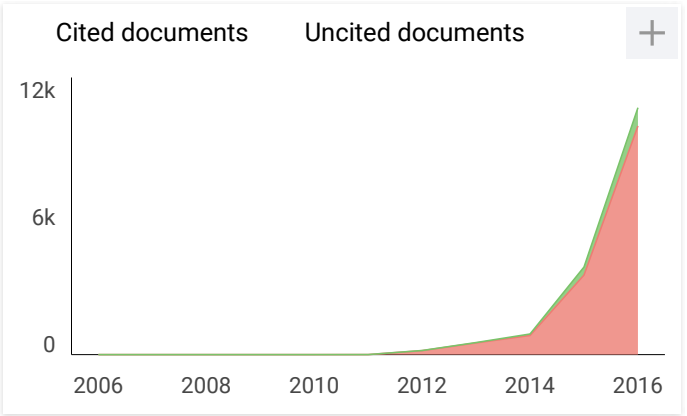

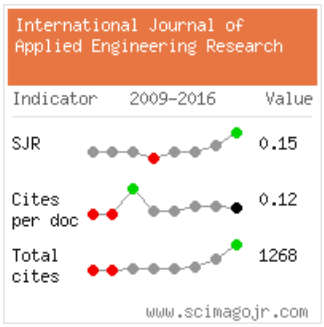

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Factor Analysis on Causal of Construction Claims and Disputes in Indonesia (with Reference to the Construction of Hydroelectric Power Project in Indonesia)

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Abstract

The main problem faced by construction industry in Indonesia is the disputes between the employer and the contractor as the impact of claim submitted by the contractor, especially in the public sector construction. Poor understanding of the contract, particularly the General Conditions of Contract is the main cause of disputes. Beside the other literature study, writer chooses the project completion reports of hydro electric power project in Indonesia as main source of information. The reason of choosing are because: First, the completion reports of hydro electric power project are the most comprehensive one, compared with other sector completion reports in Indonesia. Second, the hydroelectric power plant construction is complex, involving many kinds of engineering discipline in the construction of roads, bridges, buildings, tunnels and other underground openings, dams, intake structures, surge tanks, penstocks, turbines, gates, generators, switchgears etc. Third, it is involves a huge construction cost, that is why it mostly conducted under the loan from the international lender institutions, where in these construction projects there are some requirements to be fulfilled by the borrower e.g. the use of FIDIC Conditions of Contract is mandatory. This paper tries to find out the main causal factors of claims which lead to disputes from the point of view of each party involved in the project execution, i.e. the employer and the contractor, through distributing the questionnaire. Then the

result is analyzed by the RII and Factor Analysis. The result of factor analysis showed that the most important main causal factor is inefficiency and disruption, therefore it could be considered as basic of discussion on all claims and disputes, because it relates to time and money and it could be quantified easily.

Keywords: claim, dispute, physical causal factor, main causal factor, conditions of contract.

1.Introduction

From the former study conducted by the writer [1] in the construction of several hydroelectric power projects, the writer intend to utilize such knowledge to be used for other construction project in general, with the reason that the hydroelectric power project are complex, involving many kinds of engineering discipline in the construction of roads, bridges, buildings, tunnels and other underground openings, dams, intake structures, surge tanks, penstocks, turbines, gates, generators, switchgears etc. With the understanding that nowadays the claims and disputes change from formerly caused by different opinion on method of measurement to the "wording and sentences" [2] in the conditions of contract, .the writer try to conduct the study on the relation of main causal factors of the claim with FIDIC Conditions of Contract. We can see in a glance, that all final contract prices for hydro power plants in Indonesia below are higher than the original contract prices but still under the appraised contract price by the lending institution-borrower-design consultant as seen in the table 1 below:

Table 2.1 Original and final contract prices of the hydro electric power plants construction in Indonesia

No	Project Name	Contract Price (Equivalent. IDR)		Appraisal
		Original	Final	
1	Saguling HEPP	IDR 112,666,840,010	IDR 223,725,333,750	IDR 235,909,375,000
2	Cirata HEPP	IDR 147,454,542,000	IDR 294,868,371,000	IDR 325,978,887,050
3	Bakaru HEPP	IDR 46,363,050,000	IDR 106,498,314,000	IDR 169,756,290,000
4	Singkarak HEPP	IDR 164,543,673,285	IDR 274,732,481,931	IDR 203,713,500,000
5	Kotapanjang HEPP	IDR 110,291,088,890	IDR 151,990,912,374	IDR 129,657,185,200
6	Besai HEPP	IDR 79,793,043,480	IDR 180,363,563.910	IDR 227,700,000,000
7	Musi HEPP	IDR 120,805,734,387	IDR 413,294,161,780	IDR 206,625,760,000

8	Sipansihaporas HEPP	IDR 163,305,435,568	IDR 259,611,561,745	IDR 399,079,687,500
9	Renun HEPP	IDR 161,561,617,760	IDR 752,799,541,027	IDR 590,686,322,000

Source: Sarwono Hardjomuljadi [3]

The development of hydro electric power plants usually requires financing from international lending institutions and therefore requires the use of fair and balanced Conditions of Contract [3][4]. More often the use of FIDIC Conditions of Contract is mandatory. Writer faced the problem to collect the information on the detail of such additional cost, because the document were kept confidential and the rest were missing, but based on the study on 10 completion report of hydroelectric power project owned by PT PLN Persero, it could be concluded that the additional contract price structure could be classified as: the first formal variation order, the second price escalation with the price escalation formulae and the third payment of claims [5], where from this three the latest is crucial one.

With reference to the former study conducted by the writer on the RII of causal factor of claims in the construction of hydroelectric power project within State Electricity Corporation of Indonesia, the writer intend to use the result of the study for other construction project, since the hydroelectric power project consist of mostly all branches of engineering construction. Thus the writer developed the following research question: 1) What are the causal factors of construction claim which may led to disputes? and 2). What are the main causal factors after reducing by factor analysis?

2. Materials and Methods

2.1. General

Since the anti corruption committee in Indonesia nowadays become very strick, the best way is to solve all the claim and dispute during the contract period as the project management cost in the site, instead of solve it after the closing of contract as the legal cost after the court's decision obtained. This way used already by the later projects above, where the additional contract prices treated as formal variation order.

Table 2.2 Summary of cost structure of hydroelectric power projects in Indonesia

	Original Contract Price	Final amount of BOQ	Discount	Formal V.O.	Price Adjustment	Payment of Claims	Final Contract Price

Saguling HEPP **Lot I** Dam, diversion tunnel, roads, bridges	USD 9,982,000 FFR 89,399,000 IDR 20,230,000,000	USD 14,588,000 FFR 126,533,000 IDR 22.251.000.000	USD FFR (1,179,000) IDR	USD 4,018,000 FFR 33,812,000 IDR 6,670,000,000	USD 5,717,000 FFR 56.362,000 IDR 17,970,000,000	USD 4,077,000 FFR 71,472,000 IDR 24,527,000,000	USD 28.400,000 FFR 287,000,000 IDR 71,688,000,000
Saguling HEPP **Lot II** Headrace tunnels, surge tanks, roads, bridges	FFR 175,518,000 IDR 22,516,000,000	FFR 160,414,000 IDR 22,263, 000		FFR 41,389,000 IDR 9,742,000,000	FFR 56.362,000 IDR 18,412,000, 000	FFR 111,439,000 IDR 21,583,000,000	FFR 385,000,000 IDR 72,000,000,000
Saguling HEPP **Lot III** Power house, roads, bridges	USD 5,619,000 FFR 54,630,000 IDR 12,242,000,000	USD 5,413,000 FFR 52,621,000 IDR 11,500,000,000		USD 5,510,000 FFR 45,756,000 IDR 11,987,000,000	USD 3,890,000 FFR 37,968,000 IDR 15,796,000,000	USD 3,788,000 FFR 60,781,000 IDR 16,140,000,000	USD 18,600,000 FFR 197,126,000 IDR 55,423,000,000
Cirata HEPP **Lot I** Dam, bottom outlet tunnel, spillway & diversion tunnels, roads, bridges	JPY 11,658,000,000 IDR 21,800,000,000	JPY 8,814,041,000 IDR 18,080,160,000	JPY (360,094,000) IDR (1,244,805,000)	JPY 3,398,145,000 IDR 11,380,398,000	JPY (765,905,000) IDR 11,709,005,000	JPY 9,423,651,000 IDR 22,977,441,000	JPY 21,068,838,000 IDR 62,902,199,000
Cirata HEP **Lot II** Intake structure, headrace tunnels, surge tanks, power house, penstock and tailrace tunnels,roads	JPY 12,532,000,000 IDR 22,733,000,000	JPY 11,659,850,000 IDR 20,456,443,000	JPY (386,266,000) IDR (1,276,569,000)	JPY 5,302,364,000 IDR 10,241,176,000	JPY (498,173,000) IDR 10,369,752,000	JPY 281,980,000 IDR 1,410,566,000	JPY 16,360,755,000 IDR 42,347,800,000
Bakaru HEP Project Lot I-II Diversion tunnel, dam, intake, headrace,surge tank, penstock, powerhouse, switchyard, roads.	USD 15,197,000 IDR 21,334,000,000	USD 14,198,000 IDR 19,955,000,000		USD 2,633,000 IDR 3,701,000,000	USD 4,204,000 IDR 3,910,000,000	USD 16,297,000 IDR 22,906,000,000	USD 37,332,000 IDR 52,473,000,000
Kotapanjang HEPP Lot I Dam, power house, roads	JPY 3,823,800,00 IDR 68,839,000,000			JPY 1,144,476,958 IDR 6,240,830,280	JPY (52,414,591) IDR 17,192,457,784		JPY 4,915,862,367 IDR 92,272,288,064
Singkarak HEPP **Lot A1 & Lot A2** Civil works	USD 12,336,378 FFR 436,505,74 IDR 94,301,700,87			USD 492,119 FFR 26,609,120 IDR 4,497,190,910	USD 2,117,292 FFR 74,663,653 IDR 21,635,456,871	USD 28,325,876 FFR 382,959,629 IDR 4,728,482,767	USD 41,096,502 FFR 817,014,729 IDR 125,162,758,421
Besai HEPP **Lot I** Civil Works	JPY 1,986,000,000 IDR 41,811,000,000			JPY 1,025,772,000 IDR 49,416,235,000	JPY (46,752,000) IDR 30,625,435,000		JPY 3,058,524,000 IDR 121,852,670,000
Sipansihaporas HEPP Lot I Dam, tunnel and power plant	USD 14,109,283 IDR 45,845,654,568			USD 1,700,750 IDR 24,932,154,151	USD (122,579) IDR 58,235,698,430		USD 15,687,454 IDR 129,013,507,145
Musi HEPP Lot I Civil works	JPY 1,477,007,041 IDR 81,989,030,407				JPY (37,041,759) IDR 20,485,967,890		JPY 4,193,662,911 IDR 303,081,977,780

Renun HEPP Lot I Main intake, tributary intake 1 s/d 8, upstream headrace tunnel, regulating pond	USD 19,351,900 IDR 35,781,900,000			USD 7,468,977 IDR 8,902,588,341	USD 4,092,355 IDR\ 17,540,724,186		USD 30,913,233 IDR 63,438,990,527
Renun HEPP Lot II Tributary Intake 9 s/d 11, Downstream Headrace Tunnel, Surge Tank, Penstock, Powerhouse, Tailrace	USD 21,489,301 IDR 37,440,200,000			USD 42,872,163 IDR 191,956,230,915	USD 5,414,925 IDR 31,448,050,743	USD 11,934,688 IDR 42,754,304,235	USD 70,847,824 IDR 261,096,481,680

Source: Extracted from Completion Reports of hydroelectric power projects owned by PT PLN [6][7][8][9][10][11][12][13]

2.2.Variation Order/Formal Change Order

Variation Order (VO) as Chow [14]: terminology used for formal change is *variation order* and in some references mentioned as change order [15]. This VO has been instructed by somebody who act for and on behalf of the employer as mentioned in the contract, given to the contractor to change the design and/or the scope of works. Typical consequences based on the clauses in the contract in relation with the issuance of VO, are: the contractor is bound and must follow the instruction given by the engineer on behalf of the employer to conduct the change, the employer is bound to pay to the contractor.

Most contract have a clause stating that a change order must be in writing, even in cases where there is no such clause, written orders make the better communication on site. Oral change order at the site, no matter how insignificant at the time or how friendly the relation may be at that time, it may lead to claims and disputes later [16]. Recovery for additional contract price can be difficult if those orders were not in writing. In 1861 Lord Wensleydale [2] said about the importance of the written word:" The question is not what the parties to a deed or other documents may have intended to do by entering into that deed, but what is the meaning of the words used in that deed: a most important distinction in all cases of construction and disregard of which often leads to erroneous conclusions".

Based on the literature study and the writer's experience, variation order that instructed orally or without following the procedure as stipulated in the contract always will become one of the causal factor of the claim which may lead to disputes. However it should be understood also that beside it may create a claim, variation order is more solution for issuing formal order and eligible for payment as what the contractor have done.

Almost in all literature variation order categorized as one causal factor of the claim, but based on the study conducted by the writer [1], supported by the data which could be extracted from the completion report of hydroelectric power project in Indonesia, it could be found that variation order is more the solution.

Variation order or formal change order cause by many reasons and the change needed is vary widely, as can be seen in the statement below:

Bakaru HEPP, "……. excavation of the headrace tunnel was also delayed for about 6 months. This works being in the critical path. The Engineer reviewed the

Contractor's performance and took necessary measures for acceleration" (Formal Change).

Bakaru HEPP, "Throughout the whole length excavation was carried out under favourable conditions without encountering bad lithology and big water seepage. In spite of such geological conditions the progress of excavation was not achieved. Since the tunnel work was in the critical path of the whole schedule, Engineer worried about the situation and took accelerating measures from January 1989 under Engineer's supervision. Consequently, the progress of excavation improved much having shortened the schedule" (Formal Change).

Bakaru HEPP, "During the construction of the powerhouse, several drastic countermeasures were taken for the execution of excavation work and concrete work to accelerate the progress of those works" (Formal Change).

Bakaru HEPP, "……. The contractor was obliged to seek a totally different resources arrangement, construction sequence and even working method" (Formal Change).

Bakaru HEPP, "The Rest House was designed and constructed on the plateau of Disposal Area P1 as additional work" (Formal Change).

Saguling HEPP, "However during the progress of work a considerable amount of changes had to be made to the slopes and the volume of excavation due to occurrence of a large number of slides along the penstock route" (Formal Change).

Saguling HEPP, Main Dam "Although river diversion was delayed by about eights months chiefly due to the delay in the commencement of the work and the difficult geologic conditions in the diversion tunnels, the overall delay was eventually shortened by five months. This was accomplished through various acceleration measures" (Fomal Change).

Saguling HEPP, Headrace Tunnel " Although the commencement of the works was delayed by about 11 months, mainly due to the delay in starting the work, timely procurement of the construction equipment and late completion of the construction facilities, the total delay was shortened by implementing various acceleration measures" (Formal Change).

Saguling HEPP, "Because the characteristic of the geology at the location, to stabilize and strengthen the foundation, three rows of 25 mm rockbolts, 15, 20 and 25 m long were used" (Formal Change).

Saguling HEPP, "A special beam was constructed along the toe as required to provide a support for the heads of the anchor and transfer the load from the anchors to the foundation" (Formal Change).

Saguling HEPP Lot 3, "Various acceleration measures were required with regard to the excavation and concrete work along the penstock route. Such special measures were also required for the work of power house" (Formal Change).

Saguling Lot 3, "Berbagai tindakan akselerasi diperlukan sehubungan dengan pekerjaan penggalian dan pembetonan sepanjang jalur pipa pesat. Tindakan khusus seperti itu juga diperlukan untuk pekerjaan pusat listrik." (Perubahan Formal).

Saguling HEPP Lot 3, " There were delays in the procedure for the approval of the tender evaluation by the GOI, so in order to reduce the impact of the above delays on the overall schedule of the project, acceleration order was issued" (Formal Chang e).

Kotapanjang HEPP, "Major Design Changes in levels, lines and positions of structures including material quality were made during construction, which consist of, change of excavation line for dam and stilling basin change in mixed proportions of concrete. Change of cofferdam type, change in target permeability, of the Muara Takus Buddhist Remain"(Formal Change).

Kotapanjang HEPP, "The temporary outlet to pass water downstream of the Dam during the initial impounding of reservoir was deleted from the dam on the understanding that closure of the diversion would take place at the start of the traditional "rainy" season" (FormalChange).

Kotapanjang HEPP, "Geological conditions were not as good as expected, therefore, the excavation line at each portion was modified and the weak rock-mass was excavated additionally to obtain the moderately sound rock. The additional excavation area was replaced with the dam concrete" (Formal Change).

Kotapanjang HEPP, "In order to shorten the construction period without additional construction cost, the type of the upstream cofferdam was revised from fill type to RCC (Roller Compacted Concrete). Changing of the downstream cofferdam from concrete gravity dam to a RCC made it easier and cheaper for removal." (Formal Change).

2.3.Construction Claim

Saguling HEP Project Lot I , VO issued: 134 items

Claims submitted by the contractor: 1.Delay to start because some additional preparation should be made on river diversion, 2.Delay to start dam excavation, delay on river diversion and the need to change construction method, 3.Spoil areas should be moved because of land acquisition problem, 4.Amount of concrete reinforcement at diversion tunnel, additional steel bar for structure as safety measure, 5. Rock condition in the diversion tunnel, Unforeseen rock formation at diversion tunnel works, 6.Additional cofferdam caused by unforeseen condition on the river water level, 7.Access road, delay on possession of site caused by delay on completion of another contractor, 8.Supply of diesel generator, Unforeseen, because of the electric supply from public grid cannot be done, 9.Weight restriction on public road, new regulation of District Government.

Saguling HEP Project Lot II , VO issued 157 items

Claims submitted by the contractor: 1.Changing of construction method, 2. Acceleration measures, additional equipment, 3.Additional works on equipment mobilization, 4.Surge tank underground works, unforeseen, additional measures on soft soil, 5. Construction of power intake structure, unforeseen additional rock anchors caused by ground conditions, 6.Government regulation on new tax regulation.

Saguling HEP Project Lot III, VO issued 155 items.

Claim submitted by the contractor: 1) Aggregate processing plant, unforeseen protection on crushing plant location, 2) Switchyard, additional slope protection, 3. Penstock excavation, inefficiency caused by additional effort, 4.Slides along the penstock route, access road, switchyard, powerhouse, additional protection needed.

Cirata HEP Project Lot I, VO issued 96 items.
Claim submitted by the contractor:1.Diversion tunnel, unforeseen caused by ground failure, 2.Andesite and breccia quarry,land acquisition delay, 3.Landslide clearance and additional protection.

Cirata HEP Project Lot II, VO issued 52 items
Claims submitted by the contractor: 1.Unforeseeable physical conditions, caused by so called artificial obstruction, 2.Additional rock anchor, additional rock anchor for slope protection, 3.Additional slope protection, additional slope protection by shot Crete with wire mesh.

Bakaru HEP Project, VO issued 99 items
Claims submitted by the contractor:1.Acceleration, order with addition eqiuipment from conventional shutter to needle beam shutter, 2.Change in design caused by geological condition, 3.Landslide protection and clearing of material, 4.Flood, strengthening of Mamasa bridge because of flood, 5.Slope failure, unforeseen additional slope protection..

Based on the hydropower project completion report, explained above, it could be concluded that additional cost are categorized as 1. formal change, 2, escalation with escalation formula, 3.payment of claims [6][7][8][9][10][11][12][13].

Another result from the literature study is extracted from the previous literature study, which formerly conducted by the writer where 59 causal factor were chosen and used as questionnaire which distributed to the construction project stakeholder, employer and contractor.

3. Results and Discussion

3.1. General

Based on the above literature study that formerly conducted by the writer the causal factors of the claim which may lead to dispute were categorized as A.Construction, B.Nature, C.Performance, D.Contractual, E.Third Parties [1][18]

A. Construction:
A1 Acceleration, A2 Availability of labor, A3 Availability of material, A4 Availability of plant & equipment, A5 Changes in design, A6 Changes in scope of work, A7 Contractor's late completion, A8 Damage o person or property, A9 Defective design, A10 Delays caused by the employer, A11 Delays caused by the contractor, A12 Design error and omission, A13 Employer furnished items, A14 Inadequate site investigation,A15 Late drawing and instruction, A16 Oral change order by employer, A17 Other contractors interference and delays, A18 Project planning and interfacing, A19 Possession of site and availability, A20 Slow client response, A21 Suspension of the works, A22 Sub contracting problem, A23 Variations in quantity, A24 Work stoppages.

B. Nature
B1 Act of God, B2 Exceptional inclement whether, B3 Subsurface conditions of geology, B4 Subsurface conditions of ground water, B5 Unforeseeable physical conditions, B6 War/threats/public riots

C. Performance
C1 Accidents' safety, C2 Defective work, C3 Inefficiency and disruption, C4 Inspections problems, C5 labor disputes, C6 lack of communication among parties, C7 Poor site management and supervision, C8 Productivity of equipment, C9 Productivity of labor, C10 Slow decision making involving all parties, C11 Suitability of material, C12 Unsuitable leadership style of contractor.

D. Contractual
D1 Ambiguities in contract documents, D2 Constructive change orders, D3 Delayed dispute resolution, D4 Delayed payment on contract and extras, D5 Different interpretation of contract document, D6 Variation order

E. Third parties
E1 Changes in law and regulations, E2 Changes in material and labor cost, E3 Cultural difference, E4 Environmental issue, E5 Government policies, E6 Inflation, E7 Interest rate, E8 National and international impact, E9 Permit and licenses, E10 Public disorder

3.2.Relative Important Index (RII)

Based on the list of causal factors collected from the former study by the writer [18], the data were collected by distributing the questionnaire to 123 respondents with certain background consisted of employers (including the consultants) and contractors. Most of them have working experience in hydroelectric power projects and have a lot experiences in handling the contractual matters and claims. The numbers of filled and returned questionnaire were 104 questionnaires consist of 51 from the employer's group and 53 from the contractor's group.

The dominant causal factors of claim which lead to dispute were determined by using the RII, based on the certain grouping, the employers group and the contractors group. RII is the terminology first used by Mayer *et al* [19]. The formula for RII have been applied based on the reference from Sudirman [20], Zaneldin [21] and Hardjomuljadi [18] on deciding the rank of causal factors of claim which lead to dispute as follows:

$$\mathbf{RII = \sum W/ (A \times N)}$$

Where W = the weight given to the factors (range from 1 to 6) times frequency of the response (number of response), A = highest weight (6 in this study), and N=total number of respondents**.**

Table 3.1 Rank of RII

Range of RII value	Ranking
85 – 100	Very important
70 - 85	Important
50 - 70	Rather Important
30 - 50	Moderate
15 - 30	Less important
0 - 15	Not important

Table 3.2 Respondents in groups

	Employer	Contractor	Total
Respondents	51	53	104

Respondents working experience

Working experience of the respondents are 9 to 28 years handling the contractual and claim matters.

Table 3.3 Average working experience of the respondents

	Employer	Contractor	Average
Experience	20	8	14

Test of Validity and reliability

Table 3.4 Reliability Statistic

Cronbach's Alpha	N of Items
.998	59

Table 3.5 Case Processing Summary

		N	%
Cases	Valid	104	100.0
	Excluded[a]	0	.0
	Total	104	100.0

a. Listwise deletion based on all variables in the procedure.

3.2.1.Employers' Group

Based on the questionnaire distributed to the employer's group, the answer of the questionnaires of 51 respondents were analysed by using RII, the result were classified into 6 ranks and then factors having range higher than 70 % which ranked *important* in the Table RII were taken.

Table 3.6 RII Result of analysis on Employers' Group

No		Causal Factor	RII	Remarks
1	A5	*Changes in design*	0.807189542	
2	D5	*Different interpretation of contract document*	0.780701754	
3	D2	*Constructive change orders*	0.760416667	
4	A14	*Inadequate site investigations*	0.732026144	
5	B3	*Subsurface conditions of geology*	0.725490196	
6	C3	*Inefficiency and disruption*	0.718954248	
7	A19	*Possession of site and availability*	0.708333333	
8	A16	*Oral changes order by employer*	0.739898990	
9	E1	*Changes in law and regulations*	0.702614379	

From the result as shown in Table 3.6 above, there were 9 dominant causal factors which could be categorized as *important.*

3.2.2.Contractors' Group

Based on the questionnaire distributed to the contractors' group, the answer of the questionnaires of 53 repondents were analysed by using RII, the result were classified into 6 ranks and then factors having range higher than 70 % which ranked *important* in the Table RII were taken.

Table 3.7 RII Result of analysis on Contractors' Group

No		Causal factor	RII	Remarks
1	A19	*Possession of site and availability*	0.88194444	
2	B3	*Subsurface conditions of geology*	0.82653061	
3	D2	*Constructive change orders*	0.81333333	
4	D5	*Different interpretation of contract document*	0.79761905	
5	C3	*Inefficiency and disruption*	0.78055556	
6	A5	*Changes in design*	0.77878788	
7	A14	*Inadequate site investigations*	0.76530612	
8	A16	*Oral changes order by employer*	0.76023392	
9	E1	*Changes in law and regulations*	0.72012579	

From the result as shown in Table 3.7 above, there were 9 dominant causal factors which could be categorized as important. Thus it will be further analysed by factor analysis method.

3.3.Factor Analysis

The factor analysis is one of the statistical method used to observe the interdependency among variables [22] [23] [24] [25]. The main reason to conduct the factor analysis is to reduce the amount of data and/or variables. Factor reduction, considering the interdependence of some variable become one factor, so called the dominant variables and factors for further analysis.

Result of factor analysis from the filled questionnaires divided into two groups, the employer and the contractor.

3.3.1.Factor Analysis of Employers' Group

Table 3.8 *KMO and Bartlett's Test* of Employers' Group

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.924
Bartlett's Test of Sphericity	Approx. Chi-Square	1055.932
	Df	36
	Sig.	.000

Measure of sampling adequacy is a statistical method for calculating the inter correlation among variables. Based on Table 3.8 above, the KMO *measure of sampling adequacy* (with index range from 0 to 1) are 0.663 > 0.500 (MSA should be > 0.500 for further analysis) with significance 0.000 < 0.05 so the variable and the above data could be analysis.

The next step is analysis on table *anti-image matrices*. In the column *anti-image correlation* could be found all variables with the mark xxx [a] have 1 variable with the value < 0.500 (MSA should be > 0.500), analysis repeated after deletion of such variable, and the final result could be seen in Table 3.9 below

Table 3.9 Anti-image Matrices of the Employers' Group

Anti-image Matrices

		A5.Changes in design	A14. Inadequate site investigations	A16.Oral changes order by employer	A19. Possession of site and availability	B3. Subsurface conditions of geology	C3. Inefficiency and disruption	D2. Constructive change orders	D5.Different interpretation of contract document	E1.Changes in law and regulations
Anti-image Covariance	A5.Changes in design	.043	.001	-.003	-.005	.009	-.002	-.010	-.037	-.005
	A14.Inadequate site investigations	.001	.035	-.021	.004	-.017	.007	-.005	-.008	-.003
	A16.Oral changes order by employer	-.003	-.021	.046	-.010	.010	-.001	.003	.005	-.008
	A19.Possession of site and availability	-.005	.004	-.010	.018	-.009	-.012	-.003	.006	-.005
	B3.Subsurface conditions of geology	.009	-.017	.010	-.009	.025	-.004	-.013	-.010	.002
	C3.Inefficiency and disruption	-.002	.007	-.001	-.012	-.004	.036	.002	-.002	-.010
	D2.Constructive change orders	-.010	-.005	.003	-.003	-.013	.002	.077	.012	-.009
	D5.Different interpretation of contract document	-.037	-.008	.005	.006	-.010	-.002	.012	.053	5.436E-005
	E1.Changes in law and regulations	-.005	-.003	-.008	-.005	.002	-.010	-.009	5.436E-005	.034
Anti-image Correlation	A5.Changes in design	.897[a]	.035	-.079	-.180	.279	-.045	-.175	-.784	-.145
	A14.Inadequate site investigations	.035	.908[a]	-.521	.153	-.571	.202	-.099	-.197	-.092
	A16.Oral changes order by employer	-.079	-.521	.928[a]	-.361	.302	-.027	.050	.093	-.192
	A19.Possession of site and availability	-.180	.153	-.361	.914[a]	-.443	-.457	-.080	.187	-.215
	B3.Subsurface conditions of geology	.279	-.571	.302	-.443	.891[a]	-.139	-.289	-.273	.053
	C3.Inefficiency and disruption	-.045	.202	-.027	-.457	-.139	.952[a]	.039	-.044	-.282
	D2.Constructive change orders	-.175	-.099	.050	-.080	-.289	.039	.971[a]	.196	-.178
	D5.Different interpretation of contract document	-.784	-.197	.093	.187	-.273	-.044	.196	.890[a]	.001
	E1.Changes in law and regulations	-.145	-.092	-.192	-.215	.053	-.282	-.178	.001	.970[a]

a. Measures of Sampling Adequacy(MSA)

Table 3.10 *Rotated Component Matrix* of the Employer's Group

Rotated Component Matrix[a]

	Component		
	1	2	3
D5.Different interpretation of contract document	.797	.390	.451
A5.Changes in design	.745	.515	.402
C3.Inefficiency and disruption	.499	.703	.485
A19.Possession of site and availability	.493	.663	.551
E1.Changes in law and regulations	.524	.658	.520
A16.Oral changes order by employer	.503	.639	.540
D2.Constructive change orders	.449	.527	.690
A14.Inadequate site investigations	.545	.467	.678
B3.Subsurface conditions of geology	.506	.521	.671

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

From the Table 3.10 above, the 9 causal factors will be analyzed further by factor analysis, in order to reduce the causal factors become main causal factors, as follows :

1. Component 1 consists of D5 and A5.
2. Component 2 consists of C3, A19, E1 and A16.
3. Component 3 consists of D2, A14, and B3.

3.3.1.1.Analysis on component 1

1	D5	*Different interpretation of contract*	0.797
2	A5	*Changes in design*	0.745

D5 Different interpretation of contract document

Different interpretation of contract document, actually related to personal capability of somebody to interpret the meaning of wording ans sentences in the contract clauses, although it is not close the possibility that somebody try to conduct the interpretation for their own benefit, it is depend on the chance and desire of somebody.

Different interpretation of contract could be minimize if the parties have more or less the same level of knowledge on the terminology used in the contract clauses [16], but different interpretation could not be change by some other action on prevention such as other causal factors are.

A5 *Changes in design*

Changes in design define as any changes on the design that stipulated in the contract document, usually based on the engineer's instruction.

Clause 1.1.6.9 "Variation" means any change to the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

Changes in design is the change to design from what is stipulated in the contract, usually initiated by the engineer through the Engineer Instruction, but sometimes proposed by the contractor. Contractor usually will submit a claim with the reason of additional resources such as workers, equipment and extension of time [4].

(i) Workers. Worker with some expertise who has been mobilized to the site, because of change, should be demobilized. In addition any damages occurred because contract between the contractor and the workers should be cancelled.

(ii) Equipments. Equipment which already purchased by the contractor and already mobilized to the site, and also advance payment which paid already to the vendor should be reimbursed by the employer.

(iii) Times. Time extension should be granted to the contractor, with the reason that the design change obstruct the contractor activities and need time recovery.

Design change if not follow the procedure may develop become *constructive change order*. Design change, same with *unforeseeable physical conditions*, are indirect causal factor which will affect the direct causal factor. Changes the design usually instructed through the formal Engineer's instruction as a variation Order or change order. Such FIDIC Conditions of Contract related:

Sub-Clause 13.1 Right to Vary

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal. The Contractor shall execute and be bound by each Variation……

Each Variation may include:

(a) Changes to the quantities of any item of work included in the Contract,

(b) Changes to the quality and other characteristics of any item of work,

(c) Changes to the levels, positions and/or dimensions of any part of the Works,

(d) Omission of any work unless it is to be carried out by others,

(e) Any additional work,

(f) Changes to the sequence or timing of the execution of the Works.

Conclusion:

A5 Changes in design has been choosen as a name of component 1, with the reason that D5 Different interpretation of contract is the incident that cannot be avoided, because the employer taking risk that the project will not get built on schedule, as what he has budgeted and as what the quality he expected, so he intend to accomplish this through

the wording and sentences in the contract, while in the contrary the contractor faces the possibility of losing a great deal of money, so he too would like the wording and sentences in the contract to be protective of his interests.

Result of Analysis on Components 1

2	*A5*	*Changes in Design*	*0.745*

3.3.1.2.Analysis on Component 2

1	*C3*	*Inefficiency and disruption*	*0.703*
2	A19	*Possession of site and availability*	0.663
3	E1	*Changes in law and regulations*	0.658
4	A16	*Oral changes order by employer*	0.639

C3 Inefficiency and disruption

Inefficiency and disruption are two words that have very strong relation each other, because if there ia a disruption it will create an impact that is the very powerful wording for claim, inefficiency [24].

Inefficiency also have tight relation with the programme, as a basic of the inefficiency calculation to be claimed by both the employer and the contractor.

A19 Possession of site and availability

Possession of site have very tight relation with FIDIC Conditions of Contract, Clause 2.1 Right of Access to the Site and Clause 8.1 Commencement of the Works [27] with the understanding that possession of site or availability of space that the contractor can start the works [27]

Sub-Clause 2.1 Right of Access to the Site

If no such time is stated in the Contract Data, the Employer shall give the Contractor right of access to, and possession of, the Site within such times as required to enable the Contractor to proceed without disruption in accordance with the programme submitted under Sub-Clause 8.3 [*Programme*].

Sub-Clause 8.1 Commencement of Works

Except otherwise specified in the Particular Conditions of Contract, the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Engineer's instruction recording the agreement of both Parties on such fulfillment and instructing to commence the Work is received by the Contract .....

(c) except if otherwise specified in the Contract Data, and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [*Compliance with Laws*] as required for the commencement of the Works; .....

If the said Engineer's instruction is not received by the Contractor within 180 days from his receipt of the Letter of Acceptance, the Contractor shall be entitled to terminate the Contract under Sub-Clause 16.2 [Termination *by Contracto*r].

Sub-Clause 8.3 Programme

The Contractor shall submit a detailed time programme to the Engineer within 28 days after receiving the notice under Sub-Clause 8.1 [*Commencement of Works*]. The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations.

Each programme shall include:

(a) the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction, erection and testing,

(b)

(c) the sequence and timing of inspections and tests specified in the Contract, and

(d) a supporting report which includes:

(i) a general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and

(ii) details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage.

Unless the Engineer, within 21 days after receiving a programme, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. .....If, at any time, the Engineer gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Engineer in accordance with this Sub-Clause.

E1 Changes in law and regulations

The changing in law and regulation of the country is very important, since the parties should respect to the law and regulation of the country where the project located, as stipulated in the FIDIC Conditions of Contract [26] as follows:

Sub-Clause 1.13 Compliance with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions:

(a) the Employer shall have obtained (or shall obtain) the planning, zoning, building permit or similar permission for the Permanent Works, and any other permissions described in the Specification as having been (or to be) obtained by the Employer; and the Employer shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so; and

(b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor

shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so, unless the Contractor is impeded to accomplish these actions and shows evidence of its diligence.

Sub-Clause 13.7 Adjustments for Changes in Legislation
The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [*Contractor's Claims*] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [*Extension of Time for Completion*], and

(b) payment of any such Cost, which shall be included in the Contract Price.

A16 Oral changes order by employer
Oral change order or unwritting variation order usually instructed by the higher level official who rare come to the site [25]. The order usually given verbally without even the confirmation of verbal instruction. Such instruction mostly could be categorized as Changes in design. The oral change order often given without engineering consideration, it may create Inadequate site investigations, i.e change the horizontal alignment of the road and/or tunnel, form the area which have been investigated move to other are which have not been investigated.

Oral changes order by employer is verbal instruction which have been given by the employer to the contractor verbally, which was not followed by written confirmation. Change is another word of Variation, as stipulated in the FIDIC Conditions of Contract:

Sub-Clause 1.1.6.9 "Variation"
means any change to the Works, which is instructed or approved as a variation under Clause 13 [*Variations and Adjustments*].

Sub-Clause 13.3 Variation Procedure
If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

(a) a description of the proposed work to be performed and a programme for its execution,

(b) the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [*Programme*] and to the Time for Completion, and

(c) the Contractor's proposal for evaluation of the Variation.

Conclusion:
C3 Inefficiency and disruption has been chosen as the name of component 2, because it is closely related with A19 Possession of site and availability, E1 Changes in law and regulation and A16 Oral changes order by employer. In case that the problem raise in relation with the above three factors, the final effect will be C3 Inefficiency and disruption.

Result of analysis on components 2

1	C3	*Inefficiency and disruption*	0.703

3.3.1.3.Analysis on Component 3

1	D2	*Constructive change order*	0.690
2	A14	*Inadequate site investigations*	0.678
3	B3	*Sub surface geological condition*	0.671

D2 Constructive Change Orders
Constructive change the contractor asserts that an action of the employer and/or the engineer amounts to a change, one that involves an adjustment of the time and money accorded under the contract term. Simple example is when the employer order the contractor to replace the pipe because there is hairline crack, but such kind of crack were not prescribed in the specifications, this could be classified as constructive change order, but usually the employer and/or the engineer argues that there is not a change.

The word constructive change actually a more an effort from the contractor to bring the situation to contractual "change" clause of contract.

A14 Inadequate site investigations
Site investigation result given to the contractor during the pre bid conference, sometimes considered not giving enough information and often used by the contractor as their base of claim submission.

The inadequate site investigation may caused by incorrect investigation procedure and/or wrong interpretation of the investigation result and/or caused by oral change order by the employer. It may cause the unforeseeable physical conditions, as stipulated in FIDIC Conditions of Contract and other standard, which is the main gate for our colleague, the lawyer.

Sub-Clause 4.12 Unforeseeable Physical Conditions
In this Sub-Clause, "physical conditions" means natural physical conditions and manmade and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions……[26]

Sub-Clause 12.1 Latent Conditions
Latent conditions are: Physical conditions on the Site and its near surrounds, including artificial things but excluding weather conditions, which differ materially from the

physical conditions which should reasonably have been anticipated by a competent Contractor at the time of the Contractor's tender, if the Contractor has inspected: [27]

Sub-Clause 5.2 Adverse Physical Condition
If the Contractor shall encounter adverse physical conditions (other than weather conditions or effects due to weather conditions on the Site) in the course of carrying out sub-surface works, which adverse physical conditions could not have been reasonably foreseen by an experienced contractor and the Contractor is of the opinion that additional cost will be incurred……." [28]

B3 Subsurface geological condition
This subsurface geological conditions, is one physical condition that may generate different interpretation of the contract document. It also have very tight relation with inadequate site investigation, which may be relate to the FIDIC Sub-Clause 4.12 Unforeseeable physical condition.

Conclusion:
The D2 Constructive change order has been chosen as the name of component 3, because it is closely related with A14 Inadequate site investigation and B3 Subsurface geological conditions. In case that the problem raise in relation with the above two factors, the final effect will be D2 Constructive change order.

Result of analysis on components 3

1	D2	*Constructive change order*	0.690

3.3.2.Factor Analysis of Contractors' Group

Table 3.11 *KMO and Bartlett's Test* of Contractor's Group

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.926
Bartlett's Test of Sphericity	Approx. Chi-Square	984.451
	Df	36
	Sig.	.000

Measure of sampling adequacy is a statistical method for calculating the inter correlation among variables. Based on Table 3.11 above, the KMO *measure of sampling adequacy* (which span 0 to 1) are 0.926 > 0.500 (MSA should be > 0.500 for further analysis) with significance 0.000 < 0.05 so the variable and the above data could be analysis.

The next step is analysis on table *anti-image matrices*. In the column *anti-image correlation* all variable with the mark xxx [a] could be found that 1 variable have the value < 0.500 (MSA should be > 0.500), analysis repeated after deletion of such variable, and the final result could be seen in Table below

.

Table 3.12 *Anti-image Matrices* of Contractor's Group

Anti-image Matrices

		A5.Changes in design	A14. Inadequate site investigations	A16.Oral changes order by employer	A19. Possession of site and availability	B3. Subsurface conditions of geology	C3. Inefficiency and disruption	D2. Constructive change orders	D5.Different interpretation of contract document	E1.Changes in law and regulations
Anti-image Covariance	A5.Changes in design	.060	.000	-.028	.024	-.008	-.020	-.019	.004	.012
	A14.Inadequate site investigations	.000	.040	-.015	.007	-.009	-.007	-.016	-.015	.005
	A16.Oral changes order by employer	-.028	-.015	.038	-.011	.002	.013	.008	-.009	-.015
	A19.Possession of site and availability	.024	.007	-.011	.068	-.027	-.010	-.026	-.018	.006
	B3.Subsurface conditions of geology	-.008	-.009	.002	-.027	.069	-.013	-.006	.013	-.008
	C3.Inefficiency and disruption	-.020	-.007	.013	-.010	-.013	.060	.009	-.013	-.030
	D2.Constructive change orders	-.019	-.016	.008	-.026	-.006	.009	.049	.002	-.011
	D5.Different interpretation of contract document	.004	-.015	-.009	-.018	.013	-.013	.002	.072	-.011
	E1.Changes in law and regulations	.012	.005	-.015	.006	-.008	-.030	-.011	-.011	.059
Anti-image Correlation	A5.Changes in design	.895[a]	.006	-.596	.370	-.125	-.332	-.349	.062	.200
	A14.Inadequate site investigations	.006	.941[a]	-.387	.127	-.180	-.142	-.372	-.278	.109
	A16.Oral changes order by employer	-.596	-.387	.897[a]	-.227	.037	.275	.175	-.173	-.328
	A19.Possession of site and availability	.370	.127	-.227	.912[a]	-.389	-.161	-.443	-.254	.092
	B3.Subsurface conditions of geology	-.125	-.180	.037	-.389	.958[a]	-.195	-.109	.190	-.119
	C3.Inefficiency and disruption	-.332	-.142	.275	-.161	-.195	.921[a]	.170	-.199	-.505
	D2.Constructive change orders	-.349	-.372	.175	-.443	-.109	.170	.924[a]	.031	-.206
	D5.Different interpretation of contract document	.062	-.278	-.173	-.254	.190	-.199	.031	.960[a]	-.176
	E1.Changes in law and regulations	.200	.109	-.328	.092	-.119	-.505	-.206	-.176	.931[a]

a. Measures of Sampling Adequacy(MSA)

Table 3.13 *Rotated Component Matrix* of Contractor's Group

Rotated Component Matrixa

	Component		
	1	2	3
A5.Changes in design	.780	.426	.437
A16.Oral changes order by employer	.695	.485	.503
A14.Inadequate site investigations	.643	.547	.503
A19.Possession of site and availability	.420	.752	.486
B3.Subsurface conditions of geology	.524	.684	.462
D2.Constructive change orders	.596	.650	.435
E1.Changes in law and regulations	.508	.504	.674
C3.Inefficiency and disruption	.502	.506	.673
D5.Different interpretation of contract	.519	.505	.653

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 8 iterations.

From Table 3.13 above, it could be seen that there are 9 causal factors which will be analyzed further by factor analysis, in order to reduce the causal factors become main causal factor, as follows:

a. Component 4 consist of A5, A16, and A14.
b. Component 5 consist of A19, B3, and D2.
c. Component 6 consist of E1, C3, and D5.

3.3.2.1.Analysis on component 4

1	A5	*Changes in Design*	0.703
2	A16	*Oral changes order by employer*	0.695
3	A14	*Inadequate site investigations*	0.643

A5 Changes in design (See above)
A16 Oral changes order by employer (See above)
A14 Inadequate site investigations (See above)

Conclusion:
Since A3 Changes in design has been chosen as name of component 1, writer choose A16 Oral changes order by employer as name of the component 4, with the reason that it may cause claims and disputes. As an example when employer order to the contractor to change the horizontal alignment of the tunnel, from the area where ground condition have been investigated, to another area, may create A14 Inadequate site investigation, because there is not enough investigation in the area, where finally the changes in design required as countermeasure.

Result of analysis on components 4

1	A16	*Oral changes order by employer*	0.695

3.3.2.2.Analysis on component 5

1	A19	*Possession of site and availability*	0.752
2	B3	*Subsurface conditions of geology*	0.684
3	D2	*Constructive change order*	0.650

A19 Possession of site and availability (See above)
B3 Subsurface conditions of geology (See above)
***D2 Constructive change order (*See above)**

Conclusion:
A19 Possession of site has been chosen as name of component 4, because it has highest value and also has close relation with other factors. D2 Constructive change order may

happen in some cases of possession of site, whilst in wider meaning it may caused by B1 Subsurface conditions of geology.

Result of analysis on components 5

1	A19	*Possession of site and availability*	0.752

3.3.2.3.Analysis on component 6

1	E1	*Change in laws and regulations*	0.674
2	C3	*Inefficiency and disruption*	0.673
3	D3	*Different interpretation of contract*	0.653

E1 Changes in Law and regulation (See above)
C3 Ineficiency and disruption (See above)
D3 Different interpretation of contract (See above)

Conclusion:
E1 Changes in Law and legislation has been chosen as a name for component 6, not only because it has the highest value but also it has very close relation with D3 Different interpretation of contract and finally will create the C3 Inefficiency and disruption.

Result of Analysis on Components 6

1	D2	*Change in laws and regulations*	0.674

4.Expert Validation

The factor analysis result showed that the main causal factors are changes in design, inefficiency and disruption, constructive change order, oral change order by employer, possession of site and availability, changes in law and legislation. The result was brought for discussion with three experts, the first is engineer/lawyer with 40 years experience used to work as claim expert in the contractor side, the second is engineer with 32 years experience, a FIDIC conditions of contract accredited trainer, the third is engineer with 35 years experience, used to work as Dispute Board for international construction projects.

Based on the discussion it could be concluded that the result is in line with international best practice. In addition, the interesting one is that the six main causal factors indicated from this research are related each other with one main causal factor, which is inefficiency and disruption. Therefore this main causal factor could be considered as the most important factor as basic of claims and disputes discussion, because it could be quantified in term of time and money.

5.Conclusion

1. Lack of comprehensive project completion report with high accuracy of data, is inhibiting factor of project administration improvement in Indonesia
2. For handling the claims and disputes properly, the contractual knowledge of the decision makers should be improved. The initial step of the above is to understand the main causal factors of the claim and dispute, since the decision maker, in this case, the employer have the most important role, compare with the consultant and contractor.
3. There are slight difference in the perception between the employer and the contractor about the hierarchy of main causal factors of claim.
4. The most important main causal factor of claim is the inefficiency and disruption. .
5. Capacity building on the contractual understanding of the employer's staffs is the most important action have to be taken by the decision makers.

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