

The Informative and Effective Approach towards Construction Contract Administration: A Modified Delphi Method

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Abstract

Every construction project tends to have contractual disagreements. A more informative and effective approach need to be considered to prevent or mitigate these contractual problems. The understanding of contract provisions needs to be reviewed, particularly on variations, which are the most litigious and problematic issues in the industry. Hence the research aims to administer the contract provisions on variations in a more clarified and resourceful manner, where a set of practical guidelines would be developed to enhance its understanding and contents of the related contract provisions. The results highlight a value added outcome, where the existing contract provisions are clarified using Plain English and also incorporated with additional information derived from the Delphi research. Eventually, the guidelines render a more understandable and informative reference that assists in decision-making.

Key Words: Project management, contract administration, contractual variations, construction, Delphi, Malaysia

1. Introduction

Construction contracts can be a complex subject if the issues corresponding to their interpretation and administration are not handled properly. Interpretation errors and misunderstanding of construction contracts can be traced to the language use in contract clauses [1-3] and legalese or technical legal terms/jargon [2, 4], which results in disagreements between the contracting parties on their rights and responsibilities within a contract form [1, 5-10]. As an antidote, the use of Plain English is claimed to be more effective and accessible towards the perceived lack of clarity and legalese problems, particularly to non-lawyers [4, 11]. It defines as English that is simple and clear [12]. Therefore, the research examines whether the contract provisions as well as certain guidelines will be more understandable after incorporating with Plain English approach.

In addition, variations are the most common dispute in the construction industry [13-15]. They are associated with contract administration and construction law. Probably, the contract provisions related to the variations are inadequate to address all the contractual obligations

and expectations faced by contracting parties. For instance, most of contract forms have defined variations as alteration, additions, substitutions and/or omissions of the works within the contract. However, no proper or detail explanation as to what extend of these variations or changes would be construed as valid or invalid variations. In connection with this, the contract provisions will be reviewed for its coverage through literature review, leading court cases as well as researchers' personal observations. This is to enhance the contract provisions of variations with regard to its principles, validity, valuations, and other related issues.

Overall, the research objectives are to examine the feasible use of Plain English for clarifying the language structure of the guidelines on contractual variations, and to enhance the coverage and contents of the existing contract provisions on contractual variations. Subsequently, a set of practical guidelines on contractual variations would be developed. This research solely depends on experts' input to achieve the objective. So, Delphi method was adopted. It is a systematic and reliable tool of eliciting experts' knowledge [16-21]. The Delphi method was modified to overcome certain methodological weaknesses to suit the research requirements, which will be discussed in details in the research methodology. Although *Pertubahan Arkitek Malaysia 2006 (PAM 2006)* contract form was adopted in this research, the results of this research could be beneficial for other countries as PAM 2006 was a revised version of PAM 1998 and PAM 1969, which was originally modeled from the Joint Contracts Tribunal or JCT 1963 form, from United Kingdom, in the year 1969. Ultimately, this research contributes towards a practical guide regarding the contractual variations, where the easily understandable and informative guidelines could be referred by developers, contractors as well as consultants in the Malaysian construction industry.

2. Construction Administration: Clarity and Variations

Construction contracts are written agreements signed by the contracting parties to define their relationships and obligations in a particular project. The biggest risk a contractor faces currently may not be associated with timely or efficient performance but with the terms and clauses in the construction contracts [8]. It is because the contractual obligations will become questionable if the terms and contents of the contract documents are not fully appreciated or understood [22]. Hence the construction contracts should not just be legal documents locked in the drawer and to be brought out only to provide protection when things go wrong. They should be statements of how the employer and contractor should jointly and cooperatively manage, monitor and control the project, so that the result would enhance both of their businesses in the future [23].

Thus, contract clarity is an undisputable necessity in this concern. It is to express intended information clearly for contractual agreements. Chong and Zin [11] propose the use of Plain English against the backdrop of the clarity problems and legalese text found in the standard form. The use of Plain English has established itself as a reform movement that focused on making the language more accessible, particularly to non-lawyers [4]. It is very practical because most of the construction practitioners do not possess a legal background. Table 1 shows Plain English usage and guideline to improve the contract form's language structure that will be applied in this research.

Table 1. Plain English usage and guidelines in standard form [11]

No.	Plain English Usage and Guidelines
1	Reduce the unnecessary words to keep it as short as possible if more than 20 words in a sentence
2	Put accurate punctuation in a "long" sentence
3	Shorten the sentence for ease of reading to average 15-20 words
4	Use positive style rather than negative style
5	Use illustrative examples or flow chart in treating procedures as processes
6	Avoid too many cross references between clauses
7	Use verbs instead of noun phrases
8	Use the active voice instead of passive voice
9	Use everyday words and grammar and only include legal terms where it has to
10	Use vertical list to break up complicated text
11	Eliminate the repetition or redundancy of words
12	Use language of obligation correctly: avoid using "shall", but still using it to express party's obligation

On the other hand, contractual issues are related to legal principles and the contractual obligations in contract documents. One of the main issues is variation, which is commonly used to denote changes in a project. Variation defines as alterations, additions or omissions in work, materials, working hours, work space, etc [24]. In addition, Clause 11.0 of PAM 2006 defines and explains all the obligations and regulations with reference to variations under the topic "Variations, Provisional and Prime Cost Sums", which consists of 41 statements/sentences. Legal cases and related literature have been reviewed as well as some inputs from researchers' observations to clarify and enhance the details of the contract clauses for better understanding and additional explanation concerned. Accordingly, the contractual variations are reorganized into four parts and consist of 81 statements, such as:

- Part A: Issuance of variations, whereby the subtopics consist of authorised person and power, period of issuance, and provisional sums.
- Part B: Validity of variations, whereby the subtopics consist of written instruction,

definition/principle of variation, addition, omission, substitution, alteration, removal and changes to the provisions.

- Part C: Valuation rules of variations, whereby the subtopics consist of Rule 1 of contract rates and prices, Rule 2 of fair adjustment, Rule 3 of fair market rates and prices, Rule 4 of daywork rates, Rule 5 of omitted work and Rule 6 of provisional quantity.
- Part D: Additional expense and subsequent circumstances caused by variations

The issuance of variations is the first subject in the sequence considered here, instead of the definition or principles about the variations as described in PAM 2006. This has been arranged to deliver a proper sequence of the contractual obligations considering a situation where the issuance is carried out wrongfully; subsequently, it would most likely be treated as an invalid variation. Next, the study describes the valuation rules of variations. Six rules in the contract form have been discussed here. The last part deals with the additional expenses and subsequent circumstances caused by variations. In addition, others relevant clauses from the contract form are also referred to and added to the list, for instance, definitions of words from Article 7, discrepancy between documents from Clause 1.4, Architect's instructions from Clause 2.2, conforming to statutory obligations from Clause 4.3, certificates and payment form Clause 30.0 and notice requirement from Clause 36.0. Most of the guidelines are derived from the contract provisions from PAM 2006, while some from the court cases and literature review as well as few from researchers' contribution. The details of the guidelines for the contractual variations are discussed in the results and analysis section.

3. Delphi

The Delphi method is the primary data collection method in this research. It is a popular method in the field of social sciences, especially at the masters' and doctoral levels [21]. A commonly agreed definition of the Delphi method was defined by Linstone and Turoff [25] as *"Delphi may be characterised as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem."* Over the years, researchers has modified and improved the Delphi method for their researches' aim and need. It is because the traditional Delphi method has always suffered from low convergence expert opinions, declined of response rate, costly, time consuming and the possibility of filtering out particular expert opinions by the researcher [26, 27]. Furthermore, in many real situations, experts' judgments can not be properly reflected in quantitative terms by having more rounds of Delphi. It will create

ambiguity due to the differences in the meanings and interpretations of the expert's opinions. Thus, utilizing fuzzy sets theory in the Delphi method could eliminate these shortcomings by using the max-min fuzzy type of Delphi method [26]. Subsequently, this method has been adopted by many researchers and described it as Fuzzy Delphi Method (FDM). The geometric mean is taken as the membership degree of triangular fuzzy numbers to denote the consensus value of the experts and avoid the impact of extreme values [27].

Nevertheless, the traditional Delphi method and the FDM have different methodological approaches. The difference is caused by the one round of investigation using the geometric mean. This issue needs to be addressed, as two of the fundamental features are absent in the Delphi process, i.e., feedback and answer revision by the experts. Although the FDM highlights its features to overcome some of the weaknesses in the traditional Delphi, it is vital to reconsider the defining features of the traditional Delphi. It is because the new data and / or view refinement along with the Delphi process would contribute important information towards this research.

Therefore, an innovative approach is proposed to overcome the methodological weaknesses from the traditional Delphi method and FDM. The proposed research approach is designed to suit the research's need and named as Delphi with Fuzzy (DwF) method. This revised method upholds the original values of the traditional Delphi method and also address the problems raised from the FDM such as the possibility of new information and answer modification by the experts. Fig. 1 illustrates the DwF research framework in carrying out this research.

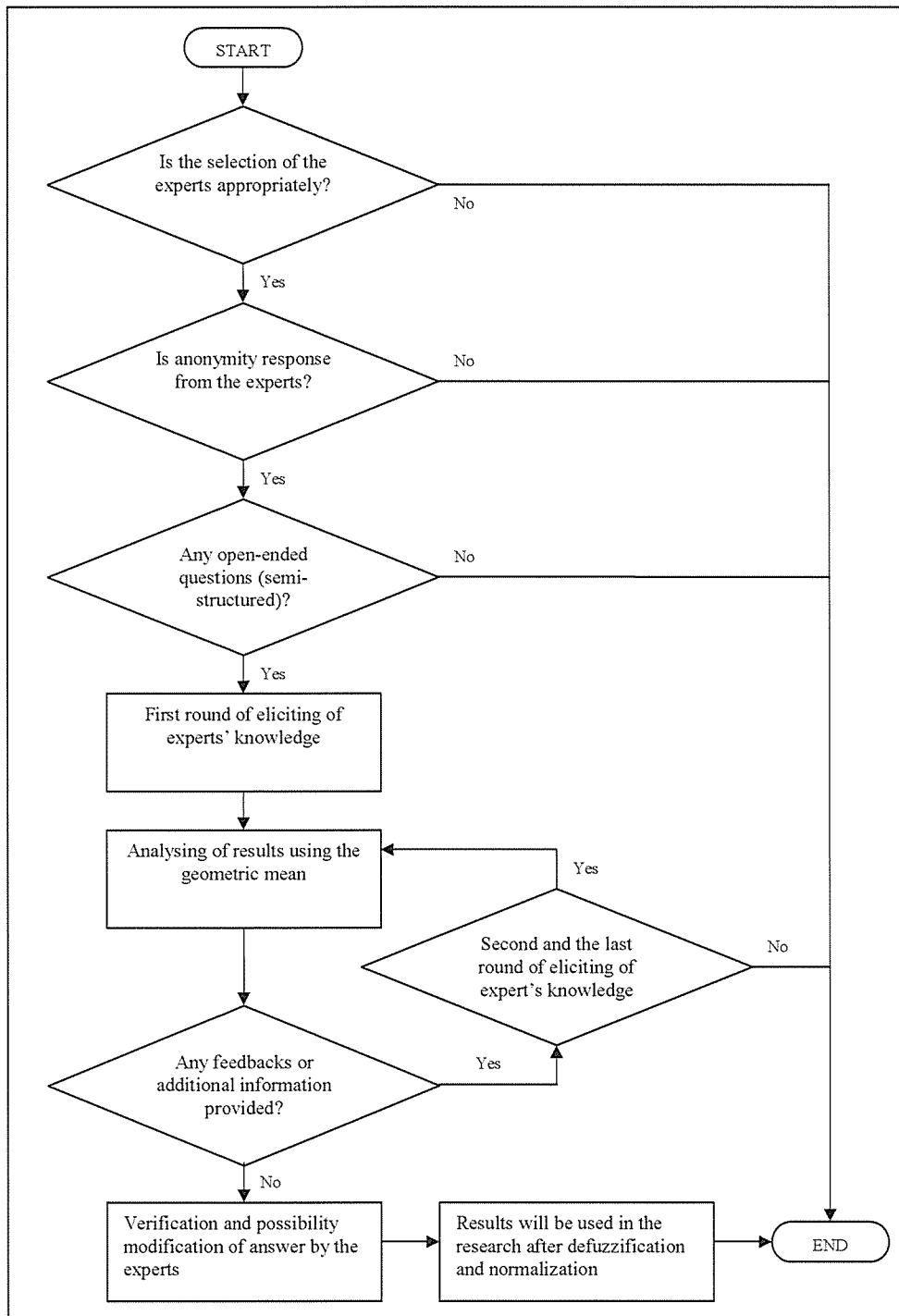


Fig. 1. DwF research framework

3.1 Delphi questionnaire and sample selection in DwF method

The experts were asked for their degree of agreement based on 11-points likert scale. The score and definition for the agreements are referred and modified from previous approaches [28, 29], i.e., 1 = absolutely disagree, 2 = strongly disagree, 3 = highly disagree, 4 = quite disagree, 5 = slightly disagree, 6 = neutral, 7 = slightly agree, 8 = quite agree, 9 = highly agree, 10 = strongly agree, and 11 = absolutely agree.

The selection of experts must be properly accomplished. It has a direct impact on the accuracy and reliability of the results. Therefore, all experts in this research were selected based on the criteria below:

- A mixture of experts with various backgrounds, such as legal professionals, engineers, architects, and quantity surveyors, is required to obtain an overall view on the contractual variations.
- An equal number of experts were appointed to avoid any biased results or findings specific to certain groups of experts.
- The experts are reputable persons based on their contributions, expertise, or publications in the construction industry.
- The willingness of the experts to participate in the interview for up to 2 rounds as required by the DwF method.

3.2 Delphi Calculation

One of the key features of the DwF method is the application of the geometric mean to calculate the value of the guidelines in the questionnaire. The maximum and minimum values of the expert opinions are calculated based on triangular fuzzy numbers. In general, the geometric mean is a type of mean or average that indicates the central tendency or typical value of a set of numbers, except that instead of adding the set of numbers and then dividing the sum by the count of numbers in the set, n , the numbers are multiplied and then the n th root of the score from the experts is calculated. Microsoft Excel is applied to calculate the geometric mean. The formula for the geometric mean (M_A) is:

$$M_A = \sqrt[n]{a_{i1}a_{i2}\dots a_{in}} \quad (3.1)$$

where a_i is the score rated by the ($1 = 1^{\text{st}}, 2 = 2^{\text{nd}} \dots n = n^{\text{th}}$) expert.

Subsequently, the geometric means were analysed for the defuzzification and normalization process. The threshold value was used to carry out the process [27]. However, the threshold

value was modified to suit this 11-scale Likert study. Therefore, for the threshold value for selection of the guidelines was based on the range of agree category. The formula to determine the interval/range for the agreement is as follows:

$$\sum I = 2X + Y \quad (3.2)$$

where,

I = Total sum up of the interval within the Likert scale;

X = Interval/range value for the category of disagreement and agreement; and

Y = Interval/range value for the neutral category.

As a result, the threshold value sets at geometric mean of 7.25 and above as the selection criteria.

Besides, three non-parametric tests were carried out in the research, such as Cronbach's Alpha, Kruskal-Wallis and Mann-Whitney *U*. The Cronbach's Alpha was a reliability test for the internal consistency, while the Kruskal-Wallis and Mann-Whitney *U* were used to examine the discrepancy [30].

4. Result and Analysis

The group consists of a mix of experts was interviewed. All the experts have had more than 20 years of working experience. They are either directors or partners in their respective companies and hold a significant role/position in the concerned professional bodies. In addition, they have a wide range of expertises in their professions as shown in Table 2.

Table 2. Background of the experts

Group	Expertise					
	Arbitration	Architectural	Engineering	QS	Contract administration	Contract drafting
Legal						
L1	√			√	√	√
L2	√	√			√	√
L3	√					√
Architect						
A1		√			√	√
A2		√			√	
A3		√			√	
Engineer						
E1	√		√		√	√
E2	√		√		√	
E3	√		√		√	
Quantity Surveyor						
(QS)	√			√	√	√
Q1				√	√	√
Q2				√	√	
Q3						

4.2. Round 1: results and feedback

The DwF method consists of two rounds. A total of eighty-one guidelines were asked in the form of a questionnaire during the first round of interview. The questionnaire included the open-ended questions that allow feedback and comments from the experts. Any changes or modifications to the guidelines during the interview have to be confirmed by the experts in the second round.

The first-round analysis discussed the experts' feedback in this section. There are two parts on the feedback, namely, improvement of and corrections to be made on the guidelines; and new information or guidelines provided by the experts. The results of the questionnaire are presented in the second round of the Delphi after confirmation by the experts.

Table 3 shows the improvements and corrections made to Part A, Issuance of Variations. The changes were based on the need of legal intent and meaning of the contract, for example, 'person' should be written as 'Person', 'local authorities' should be described along with service providers, and a clearer meaning provided for 'subcontract works'. These terms and language structures were edited to present the intended meaning of the contract.

Table 3. Improvements and corrections on Part A

Item	Original version	Improved version
A1	The right person is the Professional Architect or other form of registered under Architect Act 1967 and named in the contract.	The right Person is the Professional Architect or other form of practice registered under Architect Act 1967 and named in the contract.
A5	If Architect issues variations that outside the scope of Work and without special authority from the Employer, he may be liable to the Employer.	If Architect issues variations that outside the scope of Contract and without expressed authority from the Employer, he may be liable to the Employer.
A7	But, after Certificate of Practical Completion (CPC) period, the variations must be necessitated by obligations or compliance with the local authorities' requirements towards the Work.	But, after CPC period, the variations must be necessitated by obligations or compliance with the local authorities and service providers' requirements towards the Work.
A8	During defect liability period (DLP) and with the consent of Employer, omission issued by the Architect for leaving the defects from the set-off is considered as a valid issuance of variation.	During DLP if the contractor fails to rectify the defects and with the consent of Employer, Architect can issue omission for leaving the defects from the set-off. The omission constitutes a valid issuance of variation.
A9	Contractor shall conform to the local authorities' requirements and proceed the work if no Architect's Instruction (AI) in response for the inconsistencies with statutory requirements within 7 days of the given written notice.	Contractor shall conform to the local authorities and service providers' requirements and proceed the work if no AI in response for the inconsistencies with statutory requirements within 7 days of the given written notice.
A14	Provisional Sums means Sums provided for Nominated Sub-contractor or Nominated Supplier of work, materials or goods in the Bill of Quantities (BQ) which cannot be determined or detailed at the time.	Provisional Sums means Sums provided in the Contract and/or for Nominated Sub-Contract for work, materials or goods in the BQ which cannot be determined or detailed at the time.
A17	AI is mandatory for expenditure of Provisional Sums, which from the expenditure of Prime Cost Sums or Provisional Sums.	AI is mandatory for expenditure of Prime Cost Sums or Provisional Sums.

In Part B, Validity of Variations, the language structure of the sentences was modified to deliver clearer message, especially for the second item that needed to emphasise the 'if' in the statement. It is more appropriate to explain the substitution as 'changing' instead of 'replacing'. These two statements are shown in Table 4.

Table 4. Improvements and corrections on Part B

Item	Original version	Improved version
B1	<i>Written notice in AI is mandatory.</i>	<i>AI must be in writing</i>
B8	<i>However, Contractor shall send a written notice to Architect before commencement of the work regarding the discrepancy or divergence between documents.</i>	<i>However, if Contractor finds any discrepancy or divergence between documents; he must send a written notice to Architect before commencement of the affected work</i>

The experts agreed with all the guidelines provided in the Part C, Valuation Rules of Variations and Part D, Additional Expenses and Subsequent Circumstances Caused by Variations in term of their language structure and meanings

Apart from that, there were two additional guidelines suggested by the experts. These guidelines aimed at enhancing the value and coverage of the contractual variations. The first guideline explained the principle and definition of omission. Item BX was the new guideline to be referred by end-users related to omission, as follows:

- An omitted work is also referred to a reduction of the quantities of the Works

The item BX located after the 16th guideline of the Part B. It would be rated for agreement by experts in the second round of the DwF method.

Besides, another guideline was located in Part D. It discussed the claim of work done for the completed variation in the contract. This was a different procedure as highlighted in Clause 11.7, which was discussed in the claim of additional expenses. Item DX was the guideline and located in the last statement of Part D, i.e.,

- However, if the contractor has applied for the properly executed variations into Interim Claim, together with complete details and particulars, the Architect shall issue an Interim Certificate within 21 days from the date of receipt of the payment application.

4.2. Round 2: statistical analysis

The second round comprised two main activities. The first activity was to confirm and verify the given results in the previous round. Next, the experts were required to rate their degree of agreement on the additional guidelines (BX and DX) regarding contractual variations.

Table 5 shows the results of the individual geometric mean for all the guidelines on the contractual variations. This statistical analysis was carried out after the confirmation of the scores and the experts' response on the new information.

Part A	M _A	Part B	M _A	Part C	M _A	Part D	M _A
A1	10.02	B1	9.87	C1	8.93	D1	8.88
A2	3.31	B2	9.53	C2	10.03	D2	7.89
A3	8.58	B3	9.69	C3	10.03	D3	8.73
A4	8.57	B4	8.55	C4	9.68	D4	5.57
A5	9.48	B5	5.86	C5	10.19	D5	9.34
A6	10.29	B6	6.43	C6	10.12	D6	9.90
A7	9.37	B7	8.18	C7	9.39	D7	9.23
A8	5.19	B8	8.52	C8	9.77	DX	9.21
A9	9.58	B9	9.71	C9	9.77		
A10	9.94	B10	9.40	C10	8.51		
A11	8.26	B11	9.65	C11	8.22		
A12	8.66	B12	9.31	C12	9.27		
A13	9.91	B13	8.93	C13	9.44		
A14	7.87	B14	7.22	C14	8.94		
A15	9.83	B15	9.73	C15	8.52		
A16	9.58	B16	8.06	C16	8.75		
A17	10.43	BX	8.68	C17	9.68		
		B17	10.37	C18	9.52		
		B18	9.69	C19	9.57		
		B19	6.10	C20	9.02		
		B20	9.48	C21	9.77		
		B21	9.34	C22	9.68		
		B22	9.48	C23	10.10		
		B23	4.36	C24	8.70		
		B24	9.30	C25	8.14		
		B25	8.70	C26	9.68		
		B26	9.25	C27	9.46		
		B27	9.25	C28	9.20		
		B28	9.24				
		B29	8.30				

Table 5: Results on the geometric mean

Most of the variables were agreed with by the experts. Eight out of eighty-three variables had been rejected as guidelines for users because they were out of the range of the “agree” category, i.e., $7.25 \leq \text{geometric mean} \leq 11.00$. It was an approximately 9.64% rejection rate for the guidelines. The rejected guidelines were as follows:

- The right person also includes the Employer of the contract (A2).
- During DLP if the contractor fails to rectify the defects and with the consent of Employer, Architect can issue omission for leaving the defects from the set-off. The omission constitutes a valid issuance of variation (A8).
- If the delivered notice was not according to the requirements in the contract, it would construe as an invalid notice and bear no liability of legal effect (B5).
- Generally, if BQ is not prepared in accordance with applicable Standard Method of

Measurement, it could be a contractual basis for a variation (B6).

- E.g., increased of 60% in excavation, 40% in sewer length and 90% in concrete, it construed as an invalid variation (B14).
- E.g., deletion of 98% made on the specified wall finish (B19).
- If the changed materials/goods are so different from the contract, it would constitute an invalid variation (B23).
- However, a claim for loss of profit will always be successful for the invalid omission (D4).

Furthermore, the Cronbach's Alpha test was applied in this statistical analysis to understand whether the data provide good support for internal consistency reliability. The result of the test indicated a value of 0.976 for the correlation among the eighty-three variables as shown in Table 6. This value was larger than 0.70. It is interpreted as a good support for the consistency of the results [30].

Table 6. Reliability test on the variables

Reliability Statistics			
All Variables			
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items	
0.976	0.983	83	
Agreed Variables			
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items	
0.982	0.985	75	

Subsequently, the agreed variables were tested again for the internal consistency reliability after the rejection. The test showed a positive result in terms of the correlation among the agreed variables. The Cronbach's Alpha value had increased from 0.976 to 0.982. In other words, the agreed variables were valid in term of the consistency reliability.

4.3. Analysis of issuance of variations

This section discusses the details of the variables associated with issuance of variations. Two variables were rejected in Part A, as described earlier. The item A2 ($M_A = 3.31$) was rejected because the experts opined that the Employer should not intervene in the issuance of variations by the Architect, even though, most often, the variations are instructed by the employer. Therefore, the Employer should seek the Architect's advice regarding the issuance of variations.

The experts were neutral or undecided regarding item A8 ($M_A = 5.19$). It is because the defects were not counted as variations in the contract, although the leaving the defects from

the set-off seemed like an omission work. Therefore, some of the experts expressed some reservations regarding the defects as omission works. Table 7 shows the agreed guidelines on the issuance of variations.

Table 7. List of agreed guidelines on issuance of variations

Item	Issuance of Variations
	Authorized Person and Power
A1	> The right Person is the Professional Architect or other form of practice registered under Architect Act 1967 and named in the contract. ¹
A3	> Architect issues variations or sanctions contractor's variations provided that the variation will not vitiate the original contract. ²
A4	> Architect's power is restricted, which he can't omit a work and give it to another contractor. ³
A5	> If Architect issues variations that outside the scope of Contract and without expressed authority from the Employer, he may be liable to the Employer. ⁴
	Period of Issuance
A6	> Architect can issue variations at any time before issuance of the Certificate of Practical Completion (CPC).
A7	<ul style="list-style-type: none"> • But, after CPC period, the variations must be necessitated by obligations or compliance with the local authorities and service providers' requirements towards the Work,⁵ or
A9	> Contractor shall conform to the local authorities and service providers' requirements and proceed the work if no AI in response for the inconsistencies with statutory requirements within 7 days of the given written notice. ⁶
A10	> AI to rectify Contractor's default is not considered as a variation either before or after the CPC.
	Provisional Sums
A11	> There are two parts of 'provisional' items for variations, i.e., Provisional Quantity and expenditure of Provisional Sums. ⁷
A12	> Provisional Quantity means the estimated quantities of work, materials or goods in the BQ which cannot be determined or detailed at the time. ⁸
A13	<ul style="list-style-type: none"> • Provisional Quantity describes as the tasks are with rates and prices for the pre-estimate quantity and it subject to re-measurement for the actual value.
A14	> Provisional Sums means Sums provided in the Contract and/or for Nominated Sub-Contract for work, materials or goods in the BQ which cannot be determined or detailed at the time. ⁹
A15	<ul style="list-style-type: none"> • Expenditure of Provisional Sums describes as the tasks but without detailed information for its quantity, and rates.
A16	> Provisional Quantity does not necessary require an AI for carrying out the work, like piling length in the Bill of Quantities (BQ).
A17	> AI is mandatory for expenditure of Prime Cost Sums or Provisional Sums. ¹⁰

4.4. Analysis of Validity of Variations

Most of the variables rejected were from this part. Five of them were rejected after the Delphi calculation. These variables were referred and derived from the court cases.

The experts opined that the court cases concerning the five variables were based on case-by-case basis. The facts of the case need to be looked into; for example, the item B5 referred to

¹ Article 7 (c) and Article 3

² Clause 11.2

³ Commissioner for Main Roads v Reed and Stewart Pty. Ltd. & Another (1974)

⁴ Mitsui Construction Co v Attorney General of Hong Kong (1987)

⁵ Clause 11.3

⁶ Clause 4.3

⁷ Clause 11.6

⁸ Article 7 (at)

⁹ Article 7 (au)

¹⁰ Clause 11.4

the notice of determination instead of the validity of variations. This constraint is also applicable to the items B14 and B19, where the basis should be the facts of the case rather than an arbitrary figure to determine the validity of variations. Moreover, the experts had doubts concerning the item B6 because sometimes there were conditions or terms in the preamble of the contract that prevent the issuance of variations due to the non-compliance with the principles of the Standard Method of Measurement (SMM).

In addition, the item B23 was also disapproved by the experts because the changed materials or goods are very common in a construction project. It would not have the severe effect like cardinal changes as highlighted in the case of *Carr v JA Berriman Pty Ltd (1953)* and *Commissioner for Main Roads v Reed and Stewart Pty Ltd and another (1974)*. Table 8 shows the agreed guidelines on the validity of variations.

Table 8. List of agreed guidelines on validity of variations

Item	Validity of Variations
	Written Instruction
B1	> AI must be in writing. ¹¹ > The AI must be in a valid mode, duly served and proved as: ¹²
B2	1. by hand, at the time of delivery and a signed of acknowledgement of receipt;
B3	2. by ordinary mail or registered post, after 3 days of posting and a receipt of posting from Post Office; or
B4	3. by facsimile transmission, at time of transmission and a transmission report generated by the transmitting equipment.
	Definition/Principle of Variation
B7	> Any errors or inaccuracies in the BQ are at the risk of employer as it constitutes a variation. ¹³
B8	> However, if Contractor finds any discrepancy or divergence between documents; he must send a written notice to Architect before commencement of the affected work. ¹⁴
B9	> Contactor must execute variation entirely at his own cost if to rectify his negligence, omission, default and/or breach of contract. ¹⁵
	Addition
B10	> Variations define as addition of design, quality or quantity of the Works. ¹⁶
B11	> An additional work is required by statutory requirement but not provided in the contract, it construed as a valid variation. ¹⁷
B12	> If an additional work is so peculiar, so unexpected and different from the contract, then it would constitute a separate contract or an invalid variation. ¹⁸
B13	> An additional work has caused the cardinal changes of agreed sum or nature of the Works, it construed as an invalid variation. ¹⁹
	Omission
B15	> Variations define as omission of design, quality or quantity of the Works. ²⁰
B16	> An omitted work is the part of the Work that no longer needed in the project, it construed as a valid omission.
BX	> An omitted work is also referred to a reduction of the quantities of the Works.
B17	> If the part of the Work is omitted and given it to another contractor, it construed as an invalid omission. ²¹
B18	

¹¹ Clause 2.2

¹² Clause 36.1, Clause 36.2 and Clause 36.3

¹³ Patman and Fortheingham Ltd v Pilditch (1904)

¹⁴ Clause 1.4

¹⁵ Clause 11.1(last sentence)

¹⁶ Clause 11.1(a)

¹⁷ Clause 4.3

¹⁸ Blue Circle Industries v Holland Dredging Co (1987)

¹⁹ Lindsay Parkinson and co Ltd v Commissioners of His Majesty's Works and Public Buildings (1949)

²⁰ Clause 11.1(a)

	> An omitted work changes the fundamental basis of the contract, it construed as an invalid omission. ²²
Item	Validity of Variations
	Substitution
B20	> Variations define as changing the work of another for its design, quality or quantity of the Work. ²³
B21	> If the changed work has caused the cardinal changes of agreed sum or nature of the Works, it construed as an invalid substitution. ²⁴
	Alteration of the Kind or Standard of Materials or Goods
B22	> Variations define as alteration or changing and modification of the kind or standard of materials or goods to be used in the Work. ²⁵
B24	> Materials supplied by the Contractor are more superior than that specified without any instruction is not considered as a variation.
	Removal of the Executed Works, Materials and Goods
B25	> Variations define as removal from site any executed works, materials and goods which are in accordance with the contract. ²⁶
	Changes to the provisions in the Contract
	Variations also define as:
B26	> Any limitation of working hours – e.g., working at night-time only. ²⁷
B27	> Working space – e.g., changing of original space to a smaller or restricted one, either inside the building or external area of the project. ²⁸
B28	> Access to or utilisation of any specific part of the Site – e.g., difficulty to access or use on the land or part of the site. ²⁹
B29	> The execution and completion of the work in specific order – e.g., changing of method of statement, construction method, etc. ³⁰

4.5. Analysis of valuation rules of variations

All the guidelines in this section were accepted by the experts. This also included the three examples illustrated for the different types of the valuation rules, such as C8, C15, and C20. The concrete structure was used as these examples because of its familiarity in construction works. They were the personal inputs from the researchers to explain and enhance the details of the valuation rules. Nevertheless, most of the variables were derived from contract provisions. There were six valuation rules regarding contractual variations. Table 9 shows the agreed guidelines on the valuation rules of variations.

Table 9. List of agreed guidelines on valuation rules of variations

Item	Valuation Rules of Variations
C1	> The Quantity Surveyor (QS) shall measure and value all variations. ³¹
C2	> The contractor shall provide assistance to the QS for any recording of site information and/or site measurements are carried out at the site. ³¹
C3	> The word 'similar' used in valuation rules cannot be taken as 'identical', it should consider the background information and facts of the variation.

²¹ Carr v JA Berriman Pty Ltd (1953) and Commissioner for Main Roads v Reed and Stewart Pty Ltd and another (1974)

²² Chadmax Plastics v Hanson and Yuncken (1984)

²³ Clause 11.1(a)

²⁴ Thorn v Mayor and Commonalty of London (1876) and Blue Circle Industries v Holland Dredging Co (1987)

²⁵ Clause 11.1(b)

²⁶ Clause 11.1 (c)

²⁷ Clause 11.1(d)(i)

²⁸ Clause 11.1(d)(ii)

²⁹ Clause 11.1(d)(iii)

³⁰ Clause 11.1(d)(iv)

³¹ Clause 11.5

C4 > The following 6 Rules apply to expenditure of Provisional Sums and Provisional Quantity.³²

Item Valuation Rules of Variations

Rule 1 of Contract Rates and Prices

C5 > It uses the original rates and prices of BQ to determine the valuation.³³

C6 > This rule applies to the variation of a similar character and executed under similar conditions. It does not significantly change the quantity of work as set out in the BQ.³³

C7 > The amount of changed quantity is minor and anticipated.

C8 • E.g., a variation caused a little change in quantity for a concrete structure, but conditions (grade, dimension or method) of the concrete structure remains.

Rule 2 of Fair Adjustment

C9 > It includes a fair adjustment into the original rates and prices of BQ to determine the valuation.³⁴

C10 > This rule applies to the variation of a similar character and either is executed or not executed under similar conditions but there is a significant change in the quantity of work carried out.³⁴

C11 > The 'fair' will depend on the whole of the contractor's pricing strategy, either properly priced or with a handsome profit margin.³⁵

C12 > If properly priced, a fair adjustment must include an element of profit except for special circumstances.³⁶

C13 >The calculation should be based upon the reasonable costs that properly incurred from the works and included elements for the cost of labour, plant, materials, overheads and profit.³⁷

> The amount of changed quantity is significant and unanticipated.

C14 • E.g., a variation caused a significant change in quantity for a concrete structure, whether under similar or different conditions (grade, dimension or method), but the concrete structure remains.

Rule 3 of Fair Market Rates and Prices

C16 > It includes a fair market rates and prices for the variation of different character.³⁸

C17 > A fair valuation must include an element of profit except for special circumstances.³⁵

C18 >The calculation should be based upon the reasonable costs that properly incurred from the works and included elements for the cost of labour, plant, materials, overheads and profit.³⁶

C19 > This fair valuation is based on the variation's character, instead of the amount of changed quantities.

• E.g., a variation made to change a concrete structure to steel/timber structure.

C20

Rule 4 of Daywork Rates

C21 > If the works cannot be properly measured and valued under the Rule 1, Rule 2 or Rule 3, the contractor shall use Rule 4.³⁹

C22 > The valuation is either from Daywork Rates in the Contract documents;⁴⁰ or where there are no such Daywork Rates, at the actual cost to the contractor of his materials, additional construction plant and scaffolding, transport and labour for the work concerned, plus fifteen (15) percent, which the percentage must include the use of all tools, standing plant, standing scaffolding, supervision, overheads & profit.⁴¹

C23 > In either case, vouchers are required for the valuation, signed by the Site Agent and verified by the Site Staff, by specifying:

• time spent daily upon the work, workers' names, materials, additional construction plant, scaffolding and transport

The vouchers must deliver to the Architect and QS at weekly intervals and the final records must deliver within 14 days after completing the work.⁴¹

C24 > QS shall not change the figure or hours in the agreed and signed Daywork rates or vouchers.

C25 > A signed Daywork sheet is only for evidence or record purposes and does not signify an entitlement to the variation.⁴²

Rule 5 of Omitted work

³² Clause 11.6

³³ Clause 11.6(a)

³⁴ Clause 11.6(b)

³⁵ Building Contract Dictionary by Chappel *et al.*(2001)

³⁶ Henry Boot Construction v Alstom Combined Cycles Ltd (2000)

³⁷ Weldon Plant Ltd v The Commissioner for The New Towns (2000)

³⁸ Clause 11.6(c)

³⁹ Clause 11.6(d)

⁴⁰ Clause 11.6(d)(i)

⁴¹ Clause 11.6(d)(ii)

⁴² Clusky v Chamberlain (1995)

- C26 > It uses the original rates and prices to determine the valuation of omitted work. If the omissions substantially vary the conditions for the remaining works are carried out, the prices of such remaining works must be valued under Rule 1, Rule 2 or Rule 3.⁴³

Item	Valuation Rules of Variations
	Rule 6 of Re-measurement on Actual Quantities (Provisional Quantity)
C27	> The QS shall re-measure the original BQ provisional quantities based on the actual quantities executed. The original rates and prices determine the valuation. ⁴⁴
C28	> The actual quantities must be based on the agreed as built drawings and/or site records.

4.6. Analysis of additional expenses and subsequent circumstances

One variable was rejected in Part D, i.e, D4. This variable was about the invalid omission that will have an entitlement to loss of profit, referring to the cases *McAlpine Humberoak Ltd v McDermott International Inc (1992)* and *Kin Wah J F Construction & Engineering Co Ltd v L&M Foundation Specialist Ltd (2004)*. The experts expressed some reservations regarding this statement because it could not provide a generic approach regarding contractual variations to end-users. It is again subject to a case-by-case consideration. Furthermore, the additional guideline that properly executed variations should be paid in the Interim Certificate was fully agreed to by the experts. This guideline (DX) is extremely important as the previous item, D7 described the Architect could ascertain the amount of the variations anytime before the Final Account because no timeframe is provided. The item DX could provide a fairer risk allocation as to the claim of variations by the contractor in the guidelines as shown in Table 10.

Table 10. List of agreed guidelines on additional expense and subsequent circumstances

Item	Additional Expense and Subsequent Circumstances Caused by Variations
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⁴³ Clause 11.6(e)

⁴⁴ Clause 11.6(f)

D1	> If a variation has caused or likely to cause the contractor to incur additional expenses, where he would not be paid under the 6 Rules. He may claim it provided that given a written notice of his intention to the Architect together with an initial estimate duly supported with all necessary calculations within 28 days from the date of the AI or CAI. The notice is a condition precedent to the claim entitlement. ⁴⁵
D2	> Subsequently, the contractor shall send to the Architect and QS complete particulars, calculations and contemporaneous records within 28 days of completing such variation. If the contractor fails to submit the required particulars within the stated time or longer period agreed by Architect in writing, then the contractor has waived his rights to the claim of additional expenses. ⁴⁶ > Loss of profit is not claimable in this provision as it was covered under the Rule 2, 3 or 4.
D3	> The Architect and QS shall have access all contractor's documents or records in the possession, custody or control and with free of charge each to them if requested until all variation claims resolved.
D5	Same for the sub-contractors and/or suppliers' documents in possession, custody or control by the Contractor. ⁴⁷ > As soon as the Architect has ascertained the amount of variations and/or additional expense, it will add into Contract Sum and include into the next Interim Certificate. ⁴⁸
D6	> The Architect could ascertain the amount anytime before Final Account as no timeframe is provided. ⁴⁸
D7	> However, if the contractor has applied for the properly executed variations into Interim Claim, together with complete details and particulars, the Architect shall issue an Interim Certificate within 21
DX	days from the date of receipt of the payment application. ⁴⁹

4.7. Analysis regarding the expert category

Since the respondents were appointed from four different backgrounds, it is important to understand whether they have the same opinion regarding the agreed guidelines of contractual variations. The nonparametric Kruskal-Wallis test was performed using the SPSS software to understand the situation.

Totally, seventy-five variables were tested. The Kruskal-Wallis test indicated that most of the guidelines had the same view of the experts, with the variables' *P*-value being larger than the critical value of significance 0.05 [30]. Only seven guidelines indicated different views from the experts in terms of the mean ranks, i.e., items A10, A14, B2, B17, C11, C15, and D1.

The differences between the guidelines needed to be further examined using the Mann-Whitney *U* test. This nonparametric significance test is conducted to assess whether two independent samples (groups) come from the same distribution. In other words, it is aimed at identifying which group of experts is different in its overall response compared with the others.

Table 11 shows the results of the Mann-Whitney *U* test for the seven guidelines. It is notable that the engineers, the main group of experts, gave different views on the items compared to the legal professionals, engineers, and quantity surveyors. Fourteen out of the twenty-one variables had statistically different values compared to the other groups, where

⁴⁵ Clause 11.7 and 11.7(a)

⁴⁶ Clause 11.7(b) and 11.8

⁴⁷ Clause 11.8

⁴⁸ Clause 11.9

⁴⁹ Clause 30.1 and 30.2

the engineers' *P*-value of asymptotic significance (2-tailed) was less than the critical value of significance 0.05. Meanwhile, the architects were placed second, with nine variables different from the other groups. The legal professionals and quantity surveyors had the least discrepancy among the groups, with eight variables differing from the other groups.

Table 11. Mann Whitney *U* test on the discrepancy items

Pair (Group)	<i>P</i> -Value (asymptotic significance, 2-tailed)						
	A10	A14	B2	B17	C11	C15	D1
Legal professional and Architect	0.034	0.121	0.121	0.037	0.121	0.121	0.121
Legal professional and Engineer	0.487	0.046	0.178	0.376	0.037	0.037	0.037
Legal professional and Quantity Surveyor	0.034	1.000	0.121	0.037	0.827	0.487	0.487
Architect and Engineer	0.121	0.034	0.034	0.121	0.025	0.025	0.025
Architect and Quantity Surveyor	1.000	0.121	1.000	1.000	0.037	0.034	0.317
Engineer and Quantity Surveyor	0.121	0.046	0.034	0.121	0.121	0.034	0.034

Furthermore, the architects and engineers were the most different pairs in terms of their agreement. However, the legal professionals and quantity surveyors shared more in terms of their common views based on the statistical analysis. Overall, the tests on the agreed guidelines indicated that the experts generally had the same degree of agreement for the variables, with more than 90% consensus based on statistical analysis.

5. Discussion

All the guidelines were incorporated with attention to the clarity aspects for better understanding. The guidelines referring to the contract provisions were all agreed to by the experts. It shows that the clarified contract provisions are valid with reference to the meaning and intention of the contract. The clarifying of the language structure is both practical and important to the construction practitioners because most of them do not have a well-trained legal background.

Besides, the coverage of the contract provisions has increased about 35% such as eleven statements (A4, A5, B7, B12, B13, B18, B21, C11, C12, C13, and C25) from legal principles, fourteen statements (A10, A13, A15, A16, B24, C3, C7, C8, C14, C15, C19, C20, C24 and C28) from the researchers' inputs as well as one statement (BX) from the expert's opinion. These statements have been added into the guidelines for the additional explanations and wider coverage towards the existing contract provisions.

In addition, the mixture of experts played a significant role in the analysis. Although they came from different backgrounds, they had a consensus view regarding the guidelines based

on the statistical analysis. The geometric means considered all the experts' views and provided a more accurate and strict result compared to the conventional arithmetic means of analysis. For example, some of the rejected variables, such as items B6 and B14, would become the agreed guidelines if the arithmetic means were applied to the variables.

6. Conclusion

The DwF research approach achieved the desired objectives from the contributions of the experts. In total, seventy-five out of eighty-three guidelines were accepted after the classification of the threshold value. The viability of Plain English adopted in the research has proven useful and important for clarifying the language structure as all the clarified contract provisions were accepted by the experts. Moreover, a set of practical guidelines has been developed and incorporated with additional information apart from the clarified contract provisions from PAM 2006. These information have enhanced the coverage and contents of the contract provisions for better explanations and references. The research renders a valuable insight for the contracting parties concerning the use of Plain English to re-structure the language used for a better understanding. It also provides an improved coverage and contents for the existing contract provisions regarding variations. In conclusion, the developed guidelines provide a more understandable and comprehensive information regarding the contractual variations, which improve decision-making outcomes.

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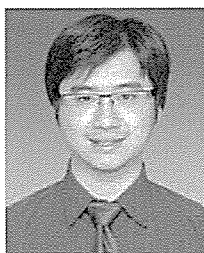
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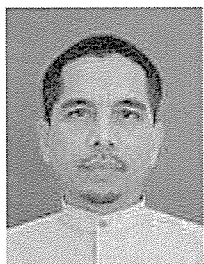
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