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Quantification Methods of Construction Claims in the Audit Process: Evidence from Indonesia

Ricki Prasetyo[1]✉ and Eliza Fatima[2]

[1, 2]Department of Accounting, Faculty of Economics and Business, Universitas Indonesia
Jl. Salemba Raya No. 4 Senen, Central Jakarta, Indonesia

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Abstract

Purpose: This study aims to evaluate the quantification method of construction claims (QMCC) used in the audit process based on the damage theory framework. An accurate quantification of claims is essentially needed to avoid construction disputes. However, earlier studies are still vague in shed light on applying the most appropriate QMCC to quantify the claims that arise from a variation order (VO).

Method: We conduct a case study using a mixed-methods approach. Surveys were given to 39 auditors at various levels (team, supervisor, and coordinator) to obtain auditors' perceptions about the relevance of the assessment criteria according to the damage theory. We analyzed the data quantitatively using non-parametric test Kruskal-Wallis/Mann-Whitney. Furthermore, in-depth interviews were conducted to 6 auditors and 2 related parties to identify the QMCC that conforms with the damage theory. Transcripts were analyzed qualitatively using theme analysis.

Finding: There is similarities in the auditors' perception in accepting the assessment criteria according to the damage theory. Quantification of claims in the audit process requires supporting evidence and causal link. In this study, we proposed three methods that can be applied using an estimated value approach.

Novelty: The QMCCs proposed have novelty in terms of contractual aspects, causality, and supporting evidence as a basis for analysis to eliminate opportunistic behavior from the parties.

Keywords: *Claim Audit, Construction Claims, Damage Theory, Quantification Method*

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INTRODUCTION

Infrastructure development has a significant impact on economic growth (Unnikrishnan & Kattookaran, 2020). However, studies from the World Economic Forum (WEF) in 2005-2012 show Indonesia has a weak level of competition for infrastructure (Maryaningsih et al., 2014). The availability of Indonesia's infrastructure in 2017 (42% of GDP) is far below the global average stock of infrastructure of 70% (KPPIP, 2019). Infrastructure development has slowed down due to a lack of coordination between stakeholders and disruption in project implementation (Ervianto, 2017). The project complexity can rise to claims due to delays or additional construction costs

author (✉)
E-mail: ricki.prasetyo@alumni.ui.ac.id

(Abdul-Malak & Abdulhai, 2017). The owner and contractor will have problems with the funding aspect that impact construction project if they have poor preparation or cannot manage claims properly (Majer et al., 2020).

The number of construction claims tends to increase significantly over the past 30 years (El-adaway & Kandil, 2009, p. 819). Empirical shreds of evidence reveal construction disputes have 23% of 16,287 civil cases in the Supreme Court (with permanent legal force) and most of the arbitration proceedings at BANI in 2014-2016 (Djatnika, 2018). Drafting clear and complete contract terms to avoid ambiguity or building a cooperative attitude between the parties is a necessary effort to minimize disputes (Mitropoulos & Howell, 2001; Zaneldin, 2006). This study focused on the contract ambiguity to scrutinize the quantification of claims (QoC) procedures that do not stipulate in the contract document. QoC accurately is an important topic to study. The controversy over particular methods can lead to disputes between the parties (Chaphalkar & Iyer, 2014; Stojadinovic, 2018). The scope of claims that need to investigate is the variation order (VO) emerging from the EPC contract. Earlier studies indicated VO as the significant source of claims (Bakhary et al., 2015; Elhag et al., 2020). A fixed price EPC contract becomes very risky if a lot of VO occurs during project implementation (Oztas & Okmen, 2004). The VO includes the changes in design or scope of works (Chester & Hendrickson, 2005).

Existing studies have largely shed light on how the occurrences of claims in a project calculated and resolved. However, there is argue about determining the QMCC. Earlier studies are still vague in shed light on applying the most appropriate QMCC to quantify the claims that arise from VO. Meanwhile, most of the claims resolve going through the negotiation process (77%) and mediation (12%), while the rest is through litigation and arbitration (Zaneldin, 2006). There still a few studies have addressed the resolution of claims through the audit process (e.g., Pérez-Castrillo & Riedinger, 2004; D. G. Anderson, 2014). Claim audit as an alternative to dispute resolution has not been explored further, thus bring about a gap in the literature.

This study, therefore, aims to evaluate the QMCC used in the audit process based on the damage theory framework. We conduct a case study using a mixed-methods approach in a supervisory agency in Indonesia. To achieve these aims, we distribute survey participation to the auditors to obtain, perceive the relevance of the assessment criteria according to the damage theory in the QoC process. We also conducted interviews with related parties to investigate the QMCCs that conform with the damage theory. Empirical data obtained from 39 survey respondents and 8 interview transcripts that reliable and valid for further analysis. We examined the data to answer the main research questions, how to apply the most appropriate QMCC to quantify the claims that arise from VO?

The contribution of this study is twofold. First, create awareness among researchers and practitioners that the audit process approach could be an alternative dispute resolution to resolve construction claims. This study can enrich the literature related to the QoC theoretically. Secondly, QMCC proposed in this study arises from the agreed claims so that auditors, owners, or contractors can use them as a reference to resolve claims. This study has practical implications by applying the damage theory related to QoC.

In general, the results of previous studies classifying QMCC into two approaches, that is the cost approach (e.g., Abdul-Malak et al., 2002; Abdul-Malak & Abdulhai, 2017; Stojadinovic, 2018; Hughes, 2020) and the estimated value approach (e.g., Chester & Hendrickson, 2005; El-adaway & Kandil, 2009; Rustom, 2012; Alshammari et al., 2017; Nasirzadeh et al., 2019; Parikh et al., 2019; Majer et al., 2020). The QoC process using the cost approach will recover all the costs of the losses suffered by the claimant. However, the cost approach has faced criticism among practitioners. The contractors can manage it to hide the losses that are not directly related to the cause of claims, for example, due to inefficiency of machines or mismanagement (Haidar, 2011). Meanwhile, the estimated value approach is widely used for practical reasons and may consider the potential lost benefits. The criticism of the estimated value approach is that the claim value calculated by specific methods may not recover all economic losses suffered by the contractor

(Hughes, 2020). While logically, the lost benefits in the future are more speculative, making it difficult to trace and prove in the QoC process (Stojadinovic, 2018). The major problem in applying this method is that the opportunism of the parties can lead to the risk of disputes when determining the estimation model (Mitropoulos & Howell, 2001). This study will address this gap in the literature using the QoC results that agreed upon and followed by the parties in the audit process. It can reduce the opportunistic behavior of the parties. Accordingly, the methods have a low risk of disputes.

According to the damage theory, claims submitted from one party to another require completed supporting evidence (Haidar, 2011; Hewitt, 2016; Evans et al., 2017). QoC, particularly compensation for VO submitted when the project has been completed, has evidence complexity due to limited information and lack of firm terms stipulated in the contract (Astarlioglu & Lechner, 2017). Evidence is historical documentation that provides the facts of a construction claim occurrence so that it binds the contractual terms under appropriate conditions (Kululanga et al., 2001). During the audit process, the auditor needs to gather essential evidence to assess particular assertions against specified criteria (Gray et al., 2015).

In addition to the emphasis on the evidence, the damage theory also states that the claim for losses filed by the claimant must have a clear causal link (Chappell et al., 2005; Evans et al., 2017; Hughes, 2020). In this case, the QoC model proposed in earlier studies uses the causal component from the initial stage of claim evaluation by identifying causes directly related to the occurrence of the claim (Abdul-Malak et al., 2002; Nasirzadeh et al., 2019). Causality inference to determine the root cause of an observational condition is also fundamental in the audit process (Srivastava et al., 2012, p. 177). The auditor may make wrong judgments about the audit. For example, when performing an analytical procedure, it finds only one cause of the anomaly where it should be due to various reasons (U. Anderson & Koonce, 1998). The study confirms that the most likely cause of an anomaly must be support by sufficient evidence.

Based on the damage theory perspective, the parties can avoid claim disputes if there is reliable evidence to evaluate the cause of the claim chronologically and to recover the losses incurred. Empirical studies show that claim disputes occur due to uncertainty, contractual problems, and opportunistic behavior (Mitropoulos & Howell, 2001). Opportunism arises because the parties have different risk profiles. In the context of an EPC contract, the owner pays a premium contract price to transfer most of the project risk to the contractor (Astarlioglu & Lechner, 2017). However, VO may arise due to unforeseen circumstances (Enshassi et al., 2010). If the owner gives formal instructions to change the scope of works in the contract (Abdul-Malak et al., 2002), then the assumption of different risk profiles is irrelevant.

Recovery of losses according to the damage theory is classified as a part of compensatory methods, consisting of expectation benefit of the bargain (BoB) dan reliance damages (RD) (Eisenberg & McDonnell, 2003; Sloof et al., 2006; Evans et al., 2017). The BoB method has the nature of the estimated value approach because it considering opportunity cost in the future. QoC using simulation model approach developed by Chester & Hendrickson (2005) applying the BoB method taking into account the lost benefit of the heavy equipment used to carry out the VO. The contractor initially should be able to use those types of equipment for other work. In other cases, the recovery of losses for the RD method relied on violations of particular clauses with out-of-pocket expenses (Evans et al., 2017, p. 12) or cash flow disbursed as an approach (historical cost). The claims administration model developed by Abdul-Malak et al. (2002) emphasizes quantifying the direct and indirect costs incurred in the project. This QoC in line with the application of the RD method.

METHODS

This research employed a case study using a mixed-methods research approach. We used mixed methods to answer several different research questions where each technique serves as a tool to confirm particular research questions (Parmelee et al., 2007; Onghena et al., 2019). In this study, we first conducted a quantitative analysis to assess respondents' perceptions and

then proceeded with a qualitative analysis to deepen the information obtained. We developed a survey quantitatively to obtain auditors' perceptions about the relevance of the assessment criteria according to the damage theory in the QoC process (RQ1). The survey result could show perceptual trends in a certain measure (closed data); however, could not explain the reasons behind their judgment to determine that QMCC conforms with the damage theory (RQ2). Therefore, it is necessary to conduct in-depth interviews (open data). Based on the research approach, the main research questions can be answered by determining the most appropriate QMCC to quantify the claims that arise from VO.

The case that becomes the unit analysis comes from the actual phenomenon (Ellet, 2007, p. 13) in a public sector supervisory agency. Unit analysis has a specific unit that carries out the claim audit function. Accordingly, it has a depth of information, peculiarity, and uniqueness of the problem under study. To conduct a fieldwork legally, we obtained consent access from the chief on duty. The data collection protocol follows the internal requirements applicable in the unit analysis.

We composed a survey using the assessment criteria according to the damage theory. A pretest was carried out by seven auditors to assess whether the statements were clear and easy to understand. The pretest results are expected to improve the design and build the instrument validity (Creswell & Creswell, 2018). The survey consists of two variables in three filling parts (see Table 1). The first part of the survey (PER01-PER08) contains statements related to the causality concept variable and its relevance in the QoC process. The second part (PER09-PER12) contains statements related to the damage valuation according to the damage theory. Furthermore, in the third section, the respondents are asked to fill in demographic data to ensure that the survey data

Table 1 The Survey Components

ID	Variable	Assessment Criteria According to the Damage Theory
PER01	Causality Concept	Proving the damages need a causal link
PER02	Causality Concept	Evidence to determine the violation and the impact of damages
PER03	Causality Concept	The effects of the damage arising from direct causes
PER04	Causality Concept	Claims from indirect causes require further consideration
PER05	Causality Concept	Test of causal to identify causes and effect of damages
PER06	Causality Concept	Background and causes of claim chronologically
PER07	Causality Concept	Claim evaluation due to additional work and design changes
PER08	Causality Concept	The claim value follows the evidence submitted by the claimant
PER09	Damage Valuation	Claims consist of actual costs and potential benefits
PER10	Damage Valuation	Compensation for additional work or design changes
PER11	Damage Valuation	Compensation must conform with supporting evidence
PER12	Damage Valuation	Quantification of the initial work value that has design changes

Source: The Processed Primary Data (2021)

includes auditors' perceptions from several different points of view. Surveys are generated online and provided to auditors using a self-completion model. Online surveys can filter respondents, have a program that makes it easy for respondents to answer, and the responses can be processed directly from the database quickly (Bryman, 2012). In the survey filling period, 46 auditors completed the survey from a population of 64 auditors. The actual response rate was 72%.

The sample data were determined based on the non-probability purposive sampling method. This study chose respondents with particular characteristics according to the predetermined knowledge and experience (Etikan et al., 2016) with the consideration that auditors who have no experience related to the claim audit found it hard to understand the intent and information contained in the statement items. As many as 7 of the 46 respondents did not fill in the experience and competence section in the construction supervision sector. The respondent did not answer the question because they did not meet the specified criteria or did not wish to respond. Therefore, the seven auditors were excluded from the survey data so that the remaining number of respondents was 39 auditors.

The survey used a Likert scale measurement of 1-5 (strongly disagree-strongly agree) to describe respondents' perceptions under certain conditions (Bryman, 2012). Consequently, the surveys produced the data with ordinal measures (Peer et al., 2012, p. 114). Data analysis consisted of reliability test (Cronbach's alpha), validity test (Spearman rho), descriptive statistics, and statistical tests. We used non-parametric statistical tests to analyze variance with ordinal data (Morgan et al., 2011). Statistical tests were run with the aid of IBM-SPSS Statistics v.27 software.

We grouped the examination of the survey data according to the job position, placement, experience, and tenure as criteria to determine the significance of the differences. The determination of the hypothesis for statistical tests is as follows:

1. H_0 : There is no significant difference in perceptions among data groups.
2. H_1 : There is a significant difference among the data groups.

The decision criteria for the test is at a significance level of 0.05 (Lind et al., 2018):

1. H_0 is accepted if H-value< critical value of chi-square (χ^2) and p -value >0.05.
2. H_0 is accepted if H-value >critical value of chi-square (χ^2) and p -value< 0.05.

We conducted statistical tests to examine the level of similarities in the auditors' perception in accepting the assessment criteria according to the damage theory. We used the Kruskal-Wallis (H) nonparametric statistical test to analyze survey data because it does not require the assumption of a normal distribution and can be used to analyze data variance with an ordinal scale (Morgan et al., 2011; Lind et al., 2018). The Kruskal-Wallis method can measure the significance of the level of difference on two or more groups of variables on average by combining all data, sorting from smallest to largest, then ranking the data groups (Lind et al., 2018).

We carried out in-depth interviews to examine auditors' considerations in conducting

Table 2 Demographic Data of Interviewee

Ref.	Identity	Position	Related Parties	Methods	Period of Work
Id.A	Interviewee 1	Coordinator	Auditor	Direct Interview	>30 years
Id.B	Interviewee 2	Team Leader	Auditor	Direct Interview	5-10 years
Id.C	Interviewee 3	Team Member	Auditor	Direct Interview	5-10 years
Id.D	Interviewee 4	Team Member	Auditor	Direct Interview	5-10 years
Id.E	Interviewee 5	Supervisor	Auditor	By Email	>20 years
Id.F	Interviewee 6	Supervisor	Auditor	By Email	>30 years
Id.G	Interviewee 7	Manager	Owner	Video Conference	>10 years
Id.H	Interviewee 8	Head of Section	Contractor	By Email	>10 years

Source: The Processed Primary Data (2021)

Table 3 List of Main Interview Questions

Research Question	Problem Themes	List of Questions
Conformity QMCC with the damage theory (RQ2)	Test of causal procedures	How do auditors perform causal tests?
		How claims that arise from VO occur?
		How are the losses charged from force majeure events?
		How does the evidence affect the value of the claim?
		How is the relevance of the damage theory with claim audit?
	QMCC	How do procedures QoC in the contract or audit guidelines?
		How is the auditors' consideration in determining the QMCC including the reference source of the price?

Source: The Processed Primary Data (2021)

causal tests and identify the QMCCs that conform with the damage theory. We developed the interview questions from the results of the survey pretest. The interviewees were selected using the non-probability purposive sampling method (Bryman, 2012). All the interviewees have practical expertise and experience in the claim audit process (see the detail in Table 2).

The interview process used semi-structured questions to identify problems more deeply and openly (Bryman, 2012). We developed an interview protocol to deliver answers according to the research question. A list of questions was prepared beforehand as a reference for the interview process (see Table 3). The interview results were processed into digital data with the consent of the interviewee. We posted the interview results into a verbatim transcript. The validity of qualitative data is carried out through member checking, namely validation data technique by presenting and providing verbatim transcriptions to the informants to be read and re-examined whether the transcription are matches the intent and information given (Creswell & Creswell, 2018). The interviewee signed the transcription after it was clarified.

The transcript data were analyzed by condensing relevant facts to the research questions. Not all factual information from interview transcription are used so that the qualitative analysis becomes focused. Subsequently, the transcription summary was coded by linking the data to the particular themes (theme analysis). We utilized document review to reduce subjectivity when interpreting the interview results. The document review can also serve as data triangulation. The documentations include technical audit guidelines, regulations, performance reports, and

Table 4 Demographic Data of the Respondents

Education (%)	Position of Auditor (%)	Tenure (%)	Experience of Supervision (number)
Diploma= 10	Supervisor= 21	<5 years= 8	Claim audit= 15
Bachelor= 69	Team Leader= 15	5-10 years= 36	Assurance in construction= 26
Master= 21	Team Member Grade 1= 3	10-20 years= 38	Consulting in construction = 14
	Team Member Grade 2= 8	>20 years= 18	Exposure related to claim audit= 30
	Team Member Grade 3= 5		Exposure related to construction= 27
	Team Member Grade 4= 49		Claim audit training/education = 12
Note: *Percentages are counted from valid respondents			Construction training/ education= 6

Source: The Processed Primary Data (2021)

Table 5 Results of The Reliability Test and The Validity Test

Variable	Cronbach's alpha (α)	Statement Items	Corrected Item-Total Correlation	Spearman rho (r-value)	Sig. (2-tailed)	Test Result
[Part 1] Causality Concept	0.913	PER01	0.715	0.801**	< 0.001	reliable & valid
		PER02	0.721	0.792**	< 0.001	reliable & valid
		PER03	0.555	0.742**	< 0.001	reliable & valid
		PER04	0.814	0.802**	< 0.001	reliable & valid
		PER05	0.780	0.786**	< 0.001	reliable & valid
		PER06	0.745	0.797**	< 0.001	reliable & valid
		PER07	0.825	0.826**	< 0.001	reliable & valid
		PER08	0.652	0.754**	< 0.001	reliable & valid
[Part 2] Damage Valuation	0.695	PER09	0.537	0.795**	< 0.001	reliable & valid
		PER10	0.520	0.791**	< 0.001	reliable & valid
		PER11	0.385	0.618**	< 0.001	reliable & valid
		PER12	0.502	0.754**	< 0.001	reliable & valid

*** Correlation is significant at the 0.01 level (2-tailed). r-table=0.408*
** Correlation is significant at the 0.05 level (2-tailed). r-table=0.316*

Source: The Processed Primary Data (2021)

minutes of meetings.

RESULTS AND DISCUSSION

The survey data consisted of 39 valid respondents for analysis. The demographic data show the auditors' characteristics according to their experience and competency criteria determined from the pretest results (see Table 4). Most of the auditors have a bachelor-level educational background with a position as a team member (grade 4) and a working period of between 5-20 years. Among the respondents, 15 auditors have direct experience in the claim audit process.

The reliability test of all variables at the 0.05 significance produces a value of α greater than 0.65 with a total correlation value of each statement item greater than 0.30 (see the detail in Table 5). The tests show that the survey statement items are positively correlated so that they can be relied on to build internal consistency (Peer et al., 2012, p. 187). The validity test using Spearman rho at the 0.05 significance results in an r-value greater than the r-table coefficient. The tests show that the survey items have a significant correlation compared to the total correlation value so that the items valid as a variable measuring tool (Morgan et al., 2011, p. 132).

The descriptive statistics summarized the central tendency and dispersion of data (see Table 6). The trend of the response for each statement item given is in the range of values 4 (agree) and 5 (strongly agree). The mean and median measures have almost similar values. Based on the

Table 6 Statistics Descriptive

Variable	Mean	Median	Std. Deviation	Skewness	Minimum	Maximum
Causality Concept	4.3654	4.2500	0.465	-0.230	3.00	5.00
Damage Valuation	4.1923	4.0000	0.484	0.002	3.00	5.00

Source: The Processed Primary Data (2021)

median, the auditors concur with the statements given to the concept of causality and damage valuation. The standard deviation is in the range of 0.4-0.5 point out a low level of data diversity. The data model will be more accurate if the data scattered in the area around the data center (Peer et al., 2012).

The results of the Kruskal-Wallis (H) are presented in Table 7. The interpretation of the test results is H0 is accepted in all data groups except for the variable test [4B]. The H statistical test shows that there is no significant difference in perceptions at a significance level of 0.05 among the data groups according to the group of positions, placement, experience, and tenure of auditors in interpreting the causality concept [1-4A] and damage valuation [1-3B].

Post hoc tests using the Mann-Whitney (U) show that on average, significant differences occur in the group of auditors [4B] with a tenure of more than 20 years (mean rank= 15.93, n= 7) and a tenure among 5-10 years (mean rank= 8.54, n= 14). There is an outlier in the data group of tenure among 5-10 years. One respondent did not concur with the reckoning of the initial work price that had undergone a design change (PER12). The survey results show similar perception in accepting the assessment criteria according to the damage theory in the QoC process. The survey data analysis indicates that QoC in the audit process requires supporting evidence and causal link.

We subsequently carried out in-depth interviews to identify and explain the basic consideration in determining the QMCC that conforms with the damage theory. The theme analysis shows two main themes from the interview data transcript. The causality theme describes the mechanism of causal tests by analyzing the description of the causes of events and effects on the contract prices. The auditor performed the causal tests by assessing the contractual, technical, and financial aspects. The test sketched the occurrence of the claim chronologically and examined the presence of owner instructions that lead to variations (Id.E, 2021). VO claims occur because of a direct order from the owner to change the design or exercise additional work before the contract is amended (Id.G, 2021; Id.H, 2021). The assigned of losses is in accordance with the provisions in the contract document. If the contract does not regulate, it is necessary to find a consideration from the authorities. A VO case takes place due to a condition against the will of the parties (force

Table 7 Results of The Statistical Test Kruskall-Wallis (H)

Data Groups	Variable Test	H-value	Critical χ^2	df	*Asymp. Sig.*	Decision
According to the Position of Auditor	[1A] Causality Concept	7.002	11.070	5	0.221	H_0 accepted
	[1B] Damage Valuation	9.749	11.070	5	0.083	H_0 accepted
According to the Placement of Work	[2A] Causality Concept	1.536	9.488	4	0.820	H_0 accepted
	[2B] Damage Valuation	0.175	9.488	4	0.996	H_0 accepted
According to the Experience	[3A] Causality Concept	0.762	5.991	2	0.683	H_0 accepted
	[3B] Damage Valuation	3.821	5.991	2	0.148	H_0 accepted
According to the Period of Work	[4A] Causality Concept	4.583	7.815	3	0.205	H_0 accepted
	[4B] Damage Valuation	8.639	7.815	3	0.034	H_0 rejected

Source: The Processed Primary Data (2021)

majeure), no party is obliged to pay compensation to other parties for default (Id.F, 2021).

The QoC in the audit process is in accordance with the completeness of the supporting evidence (Id.A, 2021). Claims audit implementation is subject to the availability of valid and relevant evidence. If the owner or contractor finds it hard to meet the required data, the audit duration will be longer (Id.A, 2021; Id.B, 2021). The auditor establishes the methods for gathering and evaluating the evidence in the claim audit procedure. The cost impact of VO is tested based on the source of the cause. The causal tests contain aspects of contractual and technical construction in the field. Completeness and documentation of supporting evidence become the basis for the QoC. The application of these procedures is in line with the causality concept in the damage theory. Furthermore, the auditor stated that:

The practice of claim audit is very relevant to the damage theory, where the claim for losses filed by the claimant must have a cause and effect relationship (causality) and supported by concrete evidence. This is can be seen in the audit guidelines that define the definition and scope of the claim. (Id.F, 2021)

The quantification method theme describes the determination process of the QMCC. Theme analysis can identify the QMCC that conforms with the damage theory. Most of the determination process of the QMCC is not clearly stipulated in the contract or audit guidelines (Id.C, 2021). This condition becomes an obstacle faced by auditors in applying the QMCC. The determination process of the QMCC uses more subjective considerations from the auditor (Id.D, 2021). The factors that become the basis for the auditor's judgment are the causes and nature of the work carried out (Id.B, 2021), the provisions in the contract document and its addendum (Id.E, 2021), and the results of negotiations between the owner and contractor (Id.H, 2021).

Auditor uses several methods to quantify claims in cases of VO. Table 8 presents the QMCCs used by the auditors that consists of:

1. The contract price proportional method. The method is applied if the price is contractually available (Id.A, 2021). The auditor calculates the claim value using the price reference approach in the contract. The method compares or adjusts the affected price of work in the contract (initial work) with the price of work according to the new design.

2. The fair value method is according to a specific reference price. The technique is applied if the VO is new works that did not previously exist in the contract, both in terms of price and technical method of implementation (Id.A, 2021). The auditor calculates claim value using analysis of new unit price based on reference price published by the competent authority or journal prices

Table 8 The QMCC Used By The Auditors

Case	Cause of claim	Type of Method	Price References
Claim 1	Change in layout design	Proportional method	Price reference in the contract
Claim 2	Additional work warehouse	Fair value method	Journal prices published by associations
Claim 3	Additional work public road	Fair value method	Journal prices published by associations
Claim 4	Change in foundation design	Proportional method	Unit price in the contract
Claim 5	Change in system supply	Appraisal method	Opinion from independent appraisal
Claim 6	Additional work structure	Fair value method	Price reference published by authority
Claim 7	Additional work conveyor	Proportional method	Price reference in the contract

Source: The Processed Primary Data (2021)

published by construction organizations or associations.

3. The fair value method is according to the independent appraisal (appraisal method). This method is used if the job is unique, peculiar, and not traded, thus there is no reference price in the market (Id.C, 2021).

The cases of claims 1, 4, and 5 occurred because of design changes. Claim 1 arose because of a design change event in the building layout followed the submitted plot plan. This event increased the volume of project facilities in the field (Id.D, 2021). The auditor used a volume comparison (initial design and installed volume) to calculate the impact of changes in contract prices. The claims were quantified using the proportional method because the initial rate and work performance techniques were available or similar to the work in the contract so that the price fluctuations can be calculated proportionally (Id.D, 2021). The same considerations apply to quantify the value of the construction claim in the case of Claim 7.

Claim 4 occurred because of a change in the foundation structure from shallow foundations to piles following the results of soil investigations (Id.B, 2021). The reference price refers to the unit price of similar components in the contract (Id.G, 2021). The claims were quantified using the proportional method. The auditor calculated the volume of piles installed in the field and subtracted the price of shallow foundations that were not executed. Whereas in the event of Claim 5, design changes in the supply system occurred due to tidal conditions that tend to be extreme (Id.C, 2021). The design was changed from a permanent type to a more complex flexible system. The auditor calculated claim value using the appraisal method because the structural work at the sea is peculiar. The system requires an independent opinion from an expert appraiser (Id.G, 2021).

Case of claims 2, 3, 6, and 7 occurred because of additional work. Any instructions from the owner to carry out VO automatically increased the value of the contract. Claims 2, 3, and 6 were quantified using the fair value method (Id.C, 2021; Id.D, 2021). The approach used to compile a unit price analysis was to adjust the available price sources using particular indices, namely the construction cost index, the inflation rate, or the wage index (Id.G, 2021).

The actual cost method can be used as an alternative to assessing VO claims. With this method, the claim value is calculated according to the actual cost or expenditure to build construction. In infield practice, the parties have never used the actual cost method because it has many constraints in acquiring prices at the location and time of VO implementation (Id.E, 2021). The use of the actual cost method requires complete evidence of construction, traceability, and reliable unit cost analysis from the commencement to the end of construction completion (Id.F, 2021; Id.H, 2021).

The results of the theme analysis show that the auditor considers the causes and nature of VO, documentation of supporting evidence, contract terms, and agreement on particular reference price to determine the QMCC. In the procedures of quantifying the claims in seven events, we found three methods applied to quantify claims, namely the proportional method, fair value method, and appraisal method. The basis for judgment from the three techniques focuses on causal tests and evidence gathering. Hence, applying the three techniques to quantify a claim conform with the assessment criteria according to the damage theory.

Perceptions about The Assessment Criteria According to The Damage Theory

Empirical evidence through survey data shows a common perception among auditors to use supporting evidence and a causal test to quantify construction claims through the audit process. The results of this study are in line with the criteria for assessing losses from a damage theory perspective (Hewitt, 2016; Evans et al., 2017). The auditors' perceptions also concur with the audit principles that define truth as conformity with reality, that is, the auditor can find these facts when doing examination based on the available evidence (Mautz & Sharaf, 1961). The implementation of evidence as a loss assessment criterion also concurs with the notion of audit evidence as information used by the auditor as a basis to conclude and provide opinions (Gray et

al., 2015; Zuca, 2015).

The results of the further study explained that the use of supporting evidence as a basis to quantify the claims could establish a clear causal link. The causality will be a logical basis for the claimant to propose a recovery for the losses suffered. These empirical results concur with the previous studies that used an evidence-based approach to quantify the value of claims in a construction project (e.g. Abdul-Malak et al., 2002; D. G. Anderson, 2014; Stojadinovic, 2018).

The auditors' perception also indicates that the auditor calculates claim value according to the documented evidence by the claimant. Evidence may arise from contract terms, project activities, and other supporting evidence. Contractual evidence is the essential source of evidence because it is legally compulsory and binding on the parties. The existence of a written request that deviates from the contract clause in project implementation is valid evidence related to VO. At this stage, the concept of the burden of proof as to the basis for assessing claims is in line with the research results by Abdul-Malak & Abdulhai (2017) that obliged contractors to collect evidence in the construction process to avoid claim disputes.

The causal tests formulated in this study are slightly different from several former studies that used the opinion of construction experts (Nasirzadeh et al., 2019; Parikh et al., 2019) or a particular claim event scenarios in a single project (Chester & Hendrickson, 2005). The studies calculated claims with global measurement (global claim). A research conducted by Hughes (2020) revealed that the application of causality to every claim case is challenging because it is impractical and disproportionate to link each cause directly to the impact of losses. These create a concept of causality with a common logic (Haidar, 2011).

The application of the concept of causality and actual evidence in this study broadens the discussion of the reasonableness of the claim value carried out by an earlier study (Stojadinovic, 2018). In some arbitration cases, compensation for variation orders was just partially approved (51%) from the number of claims submitted because some bills were not supported by sufficient evidence (Chaphalkar & Iyer, 2014). According to the research results, causality can be applied on a case-by-case basis. The parties can establish the quantification of claims for each specific claim event. In this study, we offered empirical evidence upon the relevance of applying the concept of causality to quantify construction claims based on actual evidence documentation. This study addresses uncertainties in the literature in determining the value of a claim individually and on a case-by-case basis.

The QMCC that Conforms with The Damage Theory

This study recommends the QMCCs for VO claims using a value-based approach. Empirical evidence through thematic analysis shows that auditors perform causal tests and evidence documentation as a basis for determining methods in the audit process. This consideration is in line with the jury verdict method expressed by Haidar (2011) because it uses sufficient evidence and facts to make a fair and logical assessment of compensation for the claimant. The auditor uses the contract rate or fair value as an alternative reference price to calculate a claim value. The claim audit function carried out by unit analysis is in line with the claims audit implemented by the DCAA which aims to prevent claims overpayment to the contractors (D. G. Anderson, 2014).

We identified three QMCCs that can be applied to quantify a claim value for VO, namely the proportional method, the fair value method, and the appraisal method. The three QMCCs are alternative methods of compensation as mentioned in the damage theory framework because they focus on recovering economic losses suffered by the contractor emerging from the VO events (Astarlioglu & Lechner, 2017; Evans et al., 2017). The QMCC used by the auditor is an empirical fact of the application of the compensation method according to the damage theory.

The results of this study support the relevance of the model of claim value estimation as proposed in previous studies (Alshammari et al., 2017; Nasirzadeh et al., 2019; Majer et al., 2020). However, the QMCC proposed in this study has novelty in terms of contractual aspect, causality, and supporting evidence as a basis for analysis. The audit evidence obtained may affect the QMCC

used. Meanwhile, the contract criteria and evidence serve as the basis for objective considerations to eliminate the opportunistic behavior from the parties in determining the QMCC.

The QMCC proposed in this study differs from the estimated value approach model in general because it does not assume the opportunity cost (e.g., Chester & Hendrickson, 2005) or the element of uncertainty (e.g., Nasirzadeh et al., 2019) in estimating the total claim value. The auditor calculates the claims based on the terms of the contract. The auditor also uses the past activities approach as the basis for evidence. This study concurs with the investigation of D. G. Anderson (2014) that when there is uncertainty in the claim value because it is not supported by complete supporting evidence, the contractor must bear the risk burden for this uncertainty. Even though it uses estimated values, the claim quantification model in this study is more similar to the RD method because it does not consider the potential lost benefits (Evans et al., 2017).

The claim value calculated by the auditor may not recover all costs incurred by the contractor (Hughes, 2020). As seen in the quantification of claims in Claim 1 and Claim 7, the application of the proportional method resulted in a significant reduction in the claim value (audit correction) from the number of claims submitted by the contractor. However, the criteria for using the proportional method follow the rate or price for similar work in the contract. The claim value correction occurred because the parties carried out the VO before the contract addendum. The contract is essential evidence and legally binding criterion for carrying out a claims audit. Therefore, the use of the proportional method was acceptable to the parties ultimately.

This investigation produces criticism in calculating claims value with a cost approach. The results showed that the actual cost method requires complete, traceable, and reliable construction evidence to analyze the construction cost per unit, from the start of implementation to the end of construction completion. The auditor has never used this method in the quantification process for impractical reasons in its application. This condition confirms the evaluation of Haidar (2011) that the QMCC with the cost approach can include cost elements that are not directly related to the claim event.

The application of QMCC in this study continues the discussion of auditing as a better tool in claim dispute resolution (D. G. Anderson, 2014). In this study, we presented empirical evidence upon the application of the RD method according to the damage theory in calculating construction claims for the VO. The application of the QMCC with the estimated value approach results in a practical claim calculation process. Meanwhile, a satisfaction of the contractual aspects, causality, and documentation of evidence is the basis for objective cost recovery. This study, therefore, can bridge the gap in applying a suitable QMCC for VO claims using a mixture of the estimated value approach and the cost approach.

CONCLUSION

Through this research, we managed to find out the answers of the main research questions into two aspects. First, the analysis of survey data through descriptive statistics and statistical tests showed the similarities of perception in accepting the assessment criteria according to the damage theory. This study presents empirical evidence upon the relevance of applying the concept of causality to quantify construction claims based on actual evidence. We carried out methodological triangulation by integrating survey data analysis and theme analysis. Therefore, it concludes that the parties can apply the assessment criteria according to the damage theory to quantify construction claims.

Secondly, the theme analysis was able to show practice in determining the QMCC with the damage theory in a more appropriate manner. This conformity comprises the application of the concept of causality, consideration of the evidence as the basis for calculating claims, and the mechanism for determining QMCC conducted by auditors. The auditor performs a causal test by assessing the satisfaction of the contractual, technical, and financial aspects. This study presents empirical evidence of the application of QMCC with a practical and objective estimated value approach. Quantification of claims in the audit process emphasizes the burden of proving past

construction costs or activities by the claimant. Therefore, it concludes that the QMCC used by the auditor to calculate the claim value conforms with the reliance damages method as mentioned in the damage theory.

Furthermore, the auditor determines the QMCC for VO based on causal tests and evidence documentation. Meanwhile, the contract rate or fair value is an alternative reference price to calculate a claim value. The results revealed the quantification of VO claim using the proportional method, the fair value method, and the appraisal method was able to answer the main research questions in determining the most appropriate QMCC to quantify the claims that arise from VO. The practical implication of the proposed method is the nature of the universal QMCC. The auditors, owners, and contractors can use the QMCC to settle claims. The QMCCs have novelty in terms of contractual aspects, causality, and supporting evidence as a basis for analysis to eliminate opportunistic behavior from the parties. We then produced a practical and objective method to quantify the claim value. All parties can accept the basis for determining the QMCC hence it has a low level of dispute risk. For that reason, this study contributes in applying the damage theory related to the quantification of constructions claims in Indonesia.

In this study, we used an auditor's perception as an approach to evaluate QMCC. To evaluate the QMCC, we recommended a method that is agreed upon and followed by the parties in the audit process. The opinions obtained from the owners and contractors in this study serve to strengthen the perceptions given by the auditors. Therefore, we did not include VO claims resolved by the parties without a claim audit procedure in the evaluation results. This study provides an opportunity for further research using the perceptions of the owners and contractors to analyze phenomena related to the determination of QMCC. Considering that not all occurrences of VO claims are subject to audit consideration, the researchers can use methods that have been agreed upon and followed up by the parties through negotiation, litigation, or mediation as material for future research. Expanding the context of the unit analysis will increase the scope of the discussion. It can enrich or strengthen the determination of the QMCC that has been researched.

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