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# Contribution of Construction Contract Administration Process Groups to Overall Contract Administration Performance

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***Abstract***— ***This paper aims to examine the relation between the performance of construction contract administration process groups (CCAPG) and the contract administration performance and establish a construction contract administration performance index (CCAPI). Through an online questionnaire,306 respondents participated in this research to rate the importance of CCAPG on CCA performance and the data were analyzed using Structural Equation Modelling (SEM). The Reliability testing is conducted using alpha coefficient Alpha >0.7, the validity testing of the structural models is conducted with Construct Reliability (CR) of value >0.7 and Average Variance Extracted (AVE) of value >0.5. Whilst the hypotheses are tested using Standardized Factor Loading of values > 0.7 and Critical Ratio (t-value) of value >1.96 and Squared Multiple Correlations (R2). The results show that the influence of CCAPG on CCAPI is positive and significant. Considering the findings, it is concluded that the performance of CCAPG almost importantly contributes equally to the contract administration performance. This research advances from previous research in its application to quantifying the effect of CCAPG, which is a new approach.***

***Index Terms***— ***Contract Administration, Project Success Factors, Key Performance Indicators, Construction Project Management Performance, Leadership***

## I. INTRODUCTION

The performance of procurement management is a crucial task that must be carried out throughout the contract's whole life cycle.. Throughout the various phases of implementation, different tasks and priorities are involved. One of these phases is the post awarding (sometimes called post-contract or construction) phase in which construction contract administration (CCA) takes place.

CCA refers to the variety of tasks performed by a third party that the employer has designated to administer the contract while construction is underway CSI [1]. CCA deals with relationships and handling all business matters pertaining to the contracting parties and their obligations and includes all paperwork relating to the building of a project. CCA is performed by an integrated team and the main function is to provide documented evidence for proper contract execution, compliance with contract provisions, fulfilling obligations, and getting rights for the aim of completing the project. During construction, the employer and CCA team acts, change orders, instructions, determinations, and advices to the contractor could affect the project outcome [2-5] and The accomplishment of project objectives should be the focus of efficient contract management procedures [6].

Literature reveals that CCA is an area that needs development due to the shortage of experts. Not only this but deficient performances of contract administration leads and several claims [7]. On the other side, literature recognized that proper CCA provides positive benefits for the project. For instance, Abotaleb and El-adaway [8] consider that effective contract management is a key element in minimizing disputes. Additionally, Bin Zakaria, Binti Ismail [9] reveals that early understanding of the administrative roles and responsibilities is important to avoid later problems and support on-time completion, cost constraints, and minimal disputes as much as possible. Further, the author emphasizes that all contracts require similar administrative processes.

Different authors and researchers have seen the process comprising the CCA differently. Bartsiotas [10], defined the contract administration process by categorizing it into various groups. According to the National Audit Office, contract administration comprises planning and governance: people: administration; managing performance: payment and incentives: risk: contract development: supplier development: supplier relationship; supplier management; and market management. Solis [11] establishes the CCA processes as contract setup; document management; performance management; risk management; changes management; relationship management; and contract closure groups while Surajbali [12], briefly summarizes CCA key groups as contractual relationship protocols; payment requirements, managing contractor's performance; managing variations or changes; contractual dispute resolution mechanisms; managing service level agreements; and managing risk. The comprehensive framework or model that would be able to capture the full dimensions and functions of the CCA is not yet shown, despite the fact that some processes, such as change management, payments, and dispute resolution, are

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common among the diverse literature.

As an attempt to have a global framework for construction contract administration without limiting the framework to a certain context or project type, Gunduz and Elsherbeny [13] established a multidimensional operation framework for managing construction contract administration performance (CAPF). In one framework, the model is comprehensive to capturing the construction contract administration key operational activities; CCA success factors; mitigation strategies to avoid poor contract administration; CCA best practices; CCA duties and obligations under the professional service contract, duties and responsibilities of the contract manager and his representatives under the various general contracting terms. Also, the CAPF model is comprehensive in determining eleven processes that could capture the multi-dimensional performance of the CCA. The eleven CCAPG included in the CAPF model are defined in Figure 1.

Based on the above studies, this study pursues to investigate the relationship between the construction contract administration process groups (CCAPG) and the overall performance of contract administration and establishes a single performance index at the level of construction projects.

### 1.1 Research Model and Hypotheses

To investigate the relationship between the eleven process groups of the CCA and its overall performance, this study proposes a model that incorporates the hypothesized relationships between CCAPG and CCAPI. This model suggests a positive relationship between the eleven CCAPG and CCAPI. In other words, the model claims that the higher performance and the better conformance of the CCAPG will lead to the more proper performance of the CCA function and increase the CCAPI. Two primary hypotheses were established by the study based on those assumptions:

- H1: The model with eleven CCAPG will aggregate the overall performance of CCA.
- H2: Each CCAPG will have a positive influence on CCAPI.

## II. MATERIAL AND METHODS

A model is developed, investigated, and tested by involving a four-steps research design. In the first step, a literature analysis, interviews with construction industry professionals, and a two-round modified Delphi research were used to select the 11 contract administration measures (i.e., CCAPG) as demonstrated by the authors' previous study [13]. In the second step, the authors establish the research hypotheses. Explanatory hypotheses were established for this study to test the relationship and causality among the independent and dependent variables. This step was followed by an online industry questionnaire survey to examine the importance of these independent variables (IV) represented by the eleven CCAPG on the dependent variable (DV) represented by CCAPI. At the last step, the data were modeled by Structural Equation Modelling (SEM) to validate the proposed theory and establish the relative effects of the independent variables on the dependent variable and establish a single performance index. Finally, the results were discussed, and a conclusion was drawn.

### 2.1 Instrument and sample

The data for this study was gathered through an online survey method. The questionnaire is made up of three parts: introduction, demographic questions and the importance of CCAPG. The last part used five-point points Likert-type scale ranging from 1 (Not at all important) to 5 (extremely important) [14-16, 17 ].

This study targets construction practitioners. While SEM calls for a 100-person minimum sample size, a sample size greater than 200 is preferred [18, 19 ]. The questionnaire was distributed to around 1000 practitioners, 366 completed questionnaires rolled back, and 336 functional questionnaires were used in data analysis.

### 2.2 Data Analysis

SPSS 25.0 has been used for descriptive statistics and measure the reliability of the scale by Cronbach alpha reliability test. Structural Equations Modeling has been employed to examine the study hypotheses and validity of the proposed model using AMOS V24.

Reliability is the variances ratio of true scores over the observed scores. The reliability of the 11 CCAPG scale has been measured with the internal consistency coefficient (Cronbach alpha). The alpha value for the used scale is found to be of value 0.943, which indicate a high internal consistency[20]. The degree to which a construct measured what it was intended to measure is known as the instrument validity [20]. Construct validity is assessed by both convergent validity and discriminant validity [21]. The agreement of independent variables proposed to measure a dependent variable and the dissimilarity between those dependent variables are thus both considered to be aspects of construct validity [21].

In this study, the validity was assessed for Construct Reliability (CR), Average Variance Extracted (AVE), and discriminant validity. Convergent validity is represented by construct reliability (CR), which is calculated from the sum of the error variance terms for a construct (ei) with a minimum value of 0.7 and the squared sum of the factor loadings for each construct (Li). A construct's ability to capture variance is measured by the AVE, which is the average of all squared factor loadings and has a minimum value of 0.5. Discriminant validity is measured by the inter-correlation between variables with a maximum value of 0.85. For a single DV, the CR value is found to be 0.943, AVE is 0.601, and the maximum inter-item correlation is 0.682; therefore, the model validity is achieved [18, 21].

## III. RESULTS

### 3.1 Demographic Findings

262 (77.98%) of the respondents have been working in

construction for more than ten years, as shown in Table (1). The majority of the respondents 249 (71.11%) are professionals registered and 187 (55.65%) are working in private sectors and 125 (37.20 %) are working in the public sector. 213 (63.39%) are working on the employer side either as an employer's representative or consultant and 117 (34.82 %) are working as contractors. The demographic findings mean that respondents' opinions would be reliable due to the good level of experience and educational level through professional registration. Additionally, responders are dispersed across the major organizations and industrial sectors. Consequently, their opinions will reflect the various viewpoints.

**Table 1.** Sample Characteristics

| Category | Frequency | % |
|---|---|---|
| **Experience Level** | | |
| Less than or equal 10 | 74 | 22.02% |
| (11 - 20) | 126 | 37.50% |
| More than 25 | 136 | 40.48% |
| **Professional Registration** | | |
| Registered | 249 | 74.11% |
| Not Registered | 87 | 25.89% |
| **Sector** | | |
| Private | 187 | 55.65% |
| Public | 125 | 37.20% |
| Mix | 24 | 7.14% |
| **Organization** | | |
| Employer | 49 | 14.58% |
| Consultant/ Designer | 164 | 48.81% |
| Contractor | 117 | 34.82% |
| Others | 6 | 1.79% |

### 3.2 Structural Model Results

Based on the research hypotheses, a structured model has been established using eleven CCAPG items as independent variables and the CCAPI as the dependent variables, as shown in Figure (1). The goodness of fit indices is shown at the lower right side of the Figure. The goodness of fit demonstrates how well-suited things are for assessing the corresponding structures. The outcome showed that the χ2/DF value of 1.632 is below the 3.0 cutoff range, indicating a very good match [18, 22]. The CFI value provided is 0.989, which is higher than the excellent cut value of 0.95. The PCLOSE value is determined to be 0.71 and the RMSEA value is 0.043, which is less than the value of 0.06 for excellent model fit (>.05. The p-value from the Bollen-Stine test is found to be 0.225 which s above 0.05 [18, 22]. Since all fit indices for the model are excellent, it can be deduced that the SEM model satisfied the requirement for goodness of fit and that the research hypothesis H1 is supported.

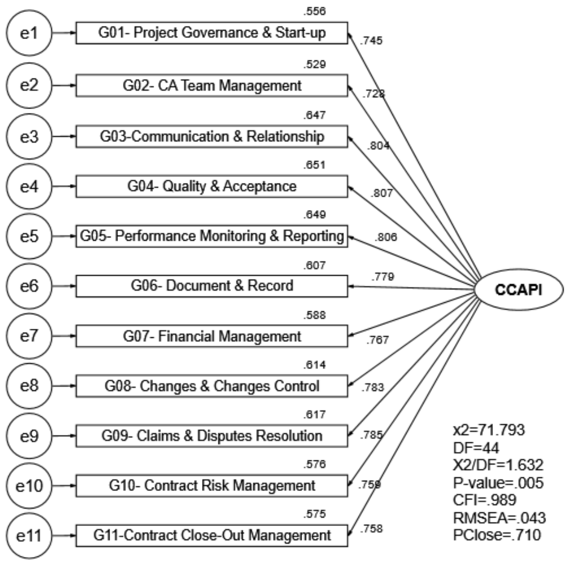


**Figure 1.** Structural model - standardized estimates

The research hypothesis H2 is examined with standardized Factor Load Factor (SFL) and Critical Ratio (t-value), as listed in Table (2). All SFL is greater than 0.7[21]. t- values are greater than 1.96, and its associated p-values are less than 0.001. As a result, at the threshold of 0.001, the regression weight for CCAPI in the prediction of any CCAPG differs significantly from zero. As a result, the H2 sub-hypotheses could be accepted, and a positive relationship is observed to exist between G01 to G11 and the CCAPI. In other words, increasing the process group performance will increase the construction contract administration's overall performance.

Thus, the suggested model (H1) and the association of CCAPI with CCAPI (H2) are well supported.

**Table 2.** Estimates for the structural parameters of the model- hypothesis tests

| Relation | T-Value | P-Value | R2 | Remarks |
|---|---|---|---|---|
| G01<--CCAPI | 15.697 | <.001 | 0.554 | H1a is supported |
| G02<--CCAPI | 15.317 | <.001 | 0.535 | H1b is supported |
| G03<--CCAPI | 17.675 | <.001 | 0.652 | H1c is supported |
| G04<--CCAPI | 17.709 | <.001 | 0.654 | H1d is supported |
| G05<--CCAPI | 17.713 | <.001 | 0.654 | H1e is supported |
| G06<--CCAPI | 16.719 | <.001 | 0.605 | H1f is supported |
| G07<--CCAPI | 16.257 | <.001 | 0.582 | H1g is supported |
| G08<--CCAPI | 16.975 | <.001 | 0.618 | H1h is supported |
| G09<--CCAPI | 17.027 | <.001 | 0.620 | H1i is supported |
| G10<--CCAPI | 16.317 | <.001 | 0.585 | H1j is supported |
| G11<--CCAPI | 16.185 | <.001 | 0.578 | H1k is supported |

## IV. ESTABLISHMENT OF THE CONSTRUCTION CONTRACT ADMINISTRATION PERFORMANCE INDEX (CCAPI)

After analytically examining the model and the association between CCAPG and CCAPI, this study further aims to establish a single index (CCAPI) that can represent the overall construction contract administration performance by correlating the relative effect of the eleven CCAPG to the CCAPI.

The methods to calculate the CCAPI is based on the methodology suggested by [23]. The methodology could be summarized in two steps: the first step is to obtain the relative effect of each CCAPG from the proposed model. A group's relative weight (RGW1j) is calculated by dividing its standardized factor loadings (SFLj) by the total of all standardized factor loadings (ΣSFLj), as shown in equation 1. the second step is to aggregate the product of the relative effect (RGW1j) multiplied by the actual performance of each group (Pj) as shown in equation 2.

$$RGW1_j = SFL_j / \Sigma SFL_j \quad \text{Eq 1}$$

$$CCAPI = \Sigma\, RGW1_j * P_j \quad \text{Eq 2}$$

Based on the above the contribution of each CCAPG to CCAPI performance is shown in Figure(2). and the contribution of the groups G1 to G11 to the CCCAPI is found to be 0.087, 0.085, 0.094, 0.095, 0.095, 0.091, 0.090, 0.092, 0.092, 0.089, and 0.089 respectively.

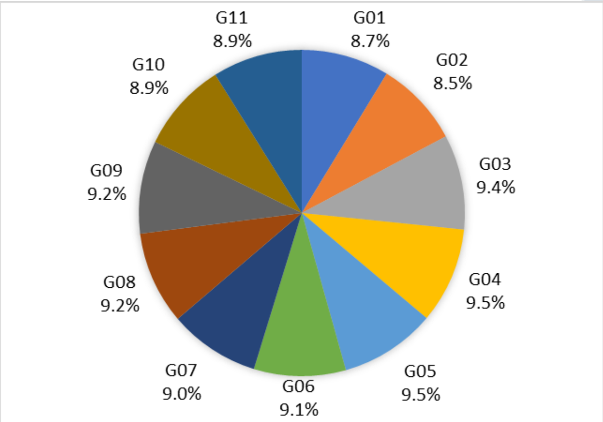


**Figure 2.** Contribution of CCAPG to CCAPI

The calculation of CCAPI is shown in equation 3.

$$CCAPI = .087*PG01 + 0.085*PG02 + 0.094*PG03 + 0.095*PG04 + 0.095*PG05 + 0.091*PG06 + 0.09*PG07 + 0.092*PG08 + 0.092*PG09 + 0.089*PG10 + 0.089*PG11 \quad \text{(Eq.3)}$$

## V. DISCUSSION

This study aims to study the relationship between CCAPG and CCAPI and establish a single performance index. After the SEM analysis, the theory suggested that the G01 to G011 is highly associated with CCAPI is well supported and consequently, CCAPI is established.

One of the significant findings in this study is G05-performance monitoring and reporting and G04 Quality & acceptance, and G03-communications and relationships are slightly more contributing to CCA performance than the other groups according to their relative effects on CCAPI.

The contract administrator's main duties include reporting and performance monitoring. In order to achieve project scope and quality within budget and schedule restrictions, the process group is an organized assessment and monitoring of the contractor's work. Because it offers a means of ensuring that the procurement objectives are being accomplished, the group is crucial to performance measures [10, 14].

The goal of the communication and relationship is to keep the CCA team and the contractor in close contact so that the services may be provided in accordance with the conditions of the contract. Some of the most important factors in construction management are solid relationships and effective communication since these factors contribute to the project's successful completion and keep the contracting parties informed of the situation and actively participating in finding solutions. The research revealed that excellent communication between the contracting parties is essential to completing projects on schedule and under budget, and it also showed that performance measurements were similarly relevant [11, 14, 24].

Through tests, inspections, investigations, and quality audits against well-defined and documented quality control and quality assurance procedures/plans, the contract administrator or his representative shall guarantee the quality of the Works during the contract's execution [6, 10, 25].

All factors are almost equally important and contribute to the effectiveness of the administration of construction contracts. In other words, there are low differences between the process groups' contributions. Thus, the findings are consistent with the assumptions that the 11 groups are obligations that should be duly discharged by the CCA team and therefore, all of them are important.

## VI. CONCLUSION

After analytically validated the association between eleven CCAPG and CCAPI and determined their relative effect on CCA performance, the study further established a single index (CCAPI) that can represent the overall construction contract administration performance.

According to the study's findings, project governance and start-up management, CA team management, communication and relationship management, quality and acceptance management, performance monitoring & reporting management, document & record management, financial management, changes & changes control management, claims & disputes resolution management, and counterclaims management are all found to have an impact on the performance of construction contract administration. Also, the results showed that the 11 process groups contributed almost equally to the construction contract administration and therefore, their performances are important to have proper contract administration. By rating the individual performance of each processes groups, the project consultant, employers, and contractors could use Equation 3 to abstract the overall performance level of the CCA and establish action plans to reduce the unwanted effect of poor CCA.

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