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Joint-contract function effects on BIM-enabled EPC project performance

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Abstract: Engineering, procurement, and construction (EPC) contracting does not promote collaboration and thus, may not be suitable for building information modeling (BIM) projects. Joint-contract functions that combine contractual control, coordination, and contingency adaptability may positively influence the performance of these BIM-enabled projects. This study hypothesized that perceived fairness, calculative trust, relational trust, and positive outcomes of distrust influence the relationship between joint contract functions and BIM-enabled project performance. It collected 252 observations from industry practitioners in EPC oil and gas projects and analyzed them using partial least squares structural equation modelling (PLS-SEM). The results show no direct effect of joint-contract functions on BIM-enabled EPC

26 project performance but do show significant total and indirect relationship effects that are

27 influenced by perceived fairness and relational trust. The findings contribute to construction

28 contracting research by empirically showing how formal contracts focusing on joint-contract

29 functions can influence BIM-enabled EPC project performance. The current findings also shed

30 light on appropriate contract framing for BIM-enabled EPC project stakeholders, an area not

31 explored in the previous literature.

32 **Keywords:** Contract Functions, Control; Coordination; Contingency Adaptability; Trust;

33 Distrust; Building Information Modelling (BIM); Engineering, Procurement, and Construction

34 (EPC)

35

36 **Introduction**

37 The use of building information modeling (BIM) has become prevalent in various industries.

38 It is not only a digital representation used to plan, design, control, and maintain facilities, it

39 also affects the conventional ways that project participants define their roles and collaborate

40 (Liu et al. 2017). Several studies argue that conventional contracting—including the

41 engineering, procurement, and construction (EPC) approach—is not suitable for projects that

42 implement BIM (e.g., Lee et al. 2018). The goals of EPC-contracting parties can conflict in the

43 following sense. First, an owner aims to complete a project within a certain timeframe and

44 budget and according to desired specifications, whereas a contractor aims to make the highest

45 possible profit from the project (Berends 2007). The conflicting positions between the owner

46 and the EPC contractor can give rise to opportunism, in which both parties do anything to

47 realize higher gains, regardless of the expense to the other (Lu et al. 2016). In addition, the

48 nature of EPC projects, which typically involve high asset specificity and uncertainties, further

49 increases the possibility of opportunistic behaviors by the contracting parties (Lee et al. 2018).

50 As such, EPC contracts grounded in transaction law (Williston and Lewis 1920) and in a

51 transaction cost economics approach usually impose more thorough contractual obligations.

52 On the one hand, more thorough contracts enable parties to minimize uncertainty and thus

53 restrain potential opportunistic behaviors (Williamson 1985). On the other hand, the contracts

54 can have detrimental effects on cooperation in a BIM work environment (Goshal and Moran

55 1996; Wuyts and Geyskens 2005). The possibility of detrimental effects prompts the

56 overarching question of what complementary approaches can best facilitate BIM

57 implementation in EPC contracts.

58   Prior research has demonstrated that formal contracts can restrain relational norms and may

59 result in distrust between the parties (Malhotra and Murnighan 2002). However, formal

60 contracts also have the potential to facilitate the development of close, cooperative

61 relationships by better aligning the expectations of parties (Mayer 2007). Schepker et al. (2014)

62 provided some important insights, including the observation that firms should focus on the

63 functional approach in contracting to succeed in their transactions. There are three main

64 contract functions in an exchange: control, coordination, and contingency adaptability

65 (Eckhard and Mellewigt 2006). To protect the contracting parties, the control function defines

66 tolerable behaviors and applicable sanctions in BIM implementation (Benaroch et al. 2016). It

67 is also used to reduce transaction and administration costs (Teng et al. 2019). Contractual

68 coordination aligns the expectations of contracting parties by harmonizing the resources and

69 activities required for delivering BIM (Eckhard and Mellewigt 2006). In the context of this

70 study, contingency adaptability (or "adaptation") refers to the provisions or guidelines for

71 handling unanticipated situations that arise from using BIM (Luo 2002). Formal contracts often

72 describe a mutually agreed tolerance zone for handling unexpected circumstances and conflicts

73 arising from using BIM. These can include solutions for delays that result from ineffective

74 collaboration among team members (Li et al. 2019), data error, or data loss. These solutions

75 and guidelines are included in engineering and construction contracts as independent terms

76 (e.g., procedures for handling delays due to BIM imperfections) or as clauses related to specific

77 areas (e.g., dispute resolutions, damages stemming from the use of BIM, etc.).

78   In this paper, it is argued that BIM in EPC projects can be implemented more effectively

79 through the lens of joint-contract functions. This approach enables firms to pay closer attention

80 to all three functions of formal contracts to improve exchange efficiency. In related previous

81 studies, Wang et al. (2017) investigated the impact of contractual control, coordination, and

82 adaptation on various aspects of relationships (such as prior interactions, standard levels of

83 cooperative behavior, and voluntary cooperative behaviors) and Quanji et al. (2016)

84 investigated the relationships between contractual control, coordination, adaptation, and

85 contractual partners' voluntary and obligatory cooperation. The two studies showed the

86 usefulness of joint-contract functions in investigating cooperative behaviors. These functions

87 can also improve project performance in BIM. As there is more potential for EPC contracting

88 parties to engage in opportunistic behaviors, joint-contract functions can play an important role

89 in effective governance for projects involving BIM. Contractual control reduces opportunistic

90 behaviors, and contractual coordination and contingency adaptability foster interorganizational

91 trust between owners and contractors, all of which enhance cooperative behaviors between

92 contracting parties and contribute to improved performance.

93   Combining the three main contract functions also helps mitigate adverse effects from the

94 individual contract functions, which also positively affects BIM-enabled project performance

95 (Lee et al. 2018). For example, high levels of control breed low levels of trust (Faulkner 2000),

96 whereas a contract environment that emphasizes coordination and contingency adaptability can

97 build and strengthen trust, thus leading to better BIM performance (Lee et al. 2018). The

98 authors of the current paper argue that interorganizational trust may influence the effect of

99 joint-contract functions on project performance. In a previous study on the effects of contracts

100 on trust, Jiang et al. (2016) showed that contracts influence relational trust positively, but they

101   did not explore how contracts influence relational trust and contribute to project success.

102   Moreover, distrust (which is often perceived in contractual contexts) can have a pernicious

103   effect on exchange performance but may have a positive impact on project performance (Lee

104   et al. 2018). Furthermore, a contractual relationship that favors fairness can reinforce trust, thus

105   leading to more effective collaboration (Benítez-Ávila et al. 2018). Perceived fairness is

106   another important variable that could mediate interorganizational trust and influence the

107   relationship between joint-contract functions and BIM-enabled project performance.

108   Against this background, this study aims to determine the direct effect of joint-contract

109   functions on BIM-enabled EPC project performance, and it also explores the mediating effects

110   of perceived fairness, interorganizational trust, and distrust. To test the research hypotheses,

111   the study employs partial least squares structural equation modeling (PLS-SEM) based on 252

112   questionnaire answers from industry practitioners involved in EPC oil and gas projects, and it

113   quantifies the direct effect of joint-contract functions on BIM-enabled project performance as

114   a complementary approach to EPC contracts. To the authors' knowledge, this is the first

115   attempt to empirically investigate the effects of formal contracts on BIM-enabled project

116   performance through the lens of joint-contract functions. Another area that has not been

117   examined by previous studies is the potential mediating effects of calculative trust and distrust,

118   relational trust, and perceived fairness between the contracting parties. By illuminating the

119   effects of joint-contract functions on EPC BIM-enabled project performance (and by

120   incorporating the mediating variables discussed above), this study provides more realistic

121   guidelines for the construction of EPC contracts based on joint-contract functions, which

122   promote effective collaboration in a BIM working environment.

123   The remainder of the paper is structured as follows. The second section discusses the

124   theoretical background and presents hypotheses that describe the relationships between joint-

125   contract functions, perceived fairness, interorganizational trust, and project performance. The

126 third section clarifies the research design, including the sampling, data collection procedures,

127 data analysis methods, and the applied measures. The fourth section presents the analysis of

128 the hypothesized model. The fifth section discusses the contributions and limitations of the

129 approach, as well as possible directions for future research. The last section concludes the

130 paper.

131

132 **Theoretical background and hypotheses development**

133 *Joint-contract functions and EPC BIM-enabled project performance*

134 As previously discussed, in the EPC approach, which emphasizes contracts and transaction

135 law, formal contracts are wielded as instruments of control (Williston and Lewis 1920; Dyer

136 1997). Furthermore, formal contracts that overly focus on control mechanisms can inhibit

137 relationship development, thereby preventing the benefits of BIM from being fully realized

138 (Huber et al. 2013). However, some degree of contractual control is necessary when using BIM

139 to mitigate the risk of exploitation (Das and Teng 1996). Contractual control not only allows

140 for behavioral control, such as through stipulating damages arising from breaching terms of

141 BIM use, but it can also take the form of input and output controls throughs terms that stipulate

142 BIM deliverables. Despite some of the detrimental effects of contractual control, Lumineau

143 and Hendersen (2012) show that contractual coordination can actually strengthen the

144 cooperative interaction between the contracting parties. Contingency adaptability provisions

145 can hinder strategic flexibility (Malhotra and Lumineau 2011), but they can also enable the

146 contracting parties to share knowledge while managing the changes associated with BIM

147 (Reuer and Devarakonda 2016).

148 There are numerous criteria for measuring successful project performance (Mir and

149 Pinnington 2014). The most common include the satisfaction of team members, value added to

150 the organization, the timeliness of projects, adherence to budgets and to the desired quality of

151 work, and effectiveness of interactions between team members (Thompson et al. 2007).

152 Contractual coordination and contingency adaptability reinforce collaboration among team

153 members in a BIM work environment by facilitating the intensive sharing of knowledge and

154 information (Zheng et al. 2017). As such, it is hypothesized that coordination and adaptability

155 directly influence the effectiveness of the interactions between team members, thus increasing

156 their work satisfaction. The harmonization between contractual control, coordination, and

157 contingency adaptability may also enhance the quality of BIM deliverables and ensure optimal

158 project performance. Parties that acknowledge the advantages of using functional contracting

159 can more easily achieve better outcomes compared with those that focus less on functional

160 contracting (Mellewigt et al. 2007). Hence, the following is hypothesized:

161 **H1**: Joint-contract functions positively and directly relate to project performance.

162

163 ***Mediation effect of interorganizational trust***

164 Trust is "*a psychological state which comprises the intention to accept vulnerability based*

165 *upon positive expectations of the intentions or behavior of another*" (Rousseau et al. 1998, p.

166 395). Specifically, interorganizational trust is a firm's expectation that another firm will not

167 behave opportunistically (Bradach and Eccles 1989). Interorganizational trust thus allows two

168 firms to exchange information and share responsibilities for decision-making (Zaheer et al.

169 1998). Interorganizational trust includes calculative, relational, and institution-based trust

170 (Rousseau et al. 1998). The aim of the current study is to determine how contract provisions

171 represented by joint-contract functions impact the trust between firms. Thus, the study

172 considers calculative and relational trust. Institutional trust, on the other hand, is affected by

173 institutional practices and exchange routines and is not part of the current analysis (Zaheer et

174 al. 1998).

175   Calculative trust arises from the positive and negative consequences that are predicted by

176   parties who are participating in a collaboration (Williamson 1993), and joint-contract functions

177   can influence the calculative judgement of parties in their evaluation of risks and potential

178   payoffs. For BIM, contract control may stipulate the damages to be paid, for example, in the

179   event of copyright infringements claimed by a third party. Contractual coordination allocates

180   the responsibilities of the parties in sharing, maintaining, and using the model, and it enables

181   parties to assess the magnitude and quality of efforts they must make in these processes. On

182   the other hand, contingency adaptability allows parties to make rational judgements about the

183   risks they bear in case of technical errors during BIM development. These functions support

184   calculative trust by allowing parties to consider the legal and economic consequences of

185   breaching contracts (Lumineau 2017).

186   Jiang et al. (2016) demonstrated that, compared to calculative trust, relational trust has a

187   more significant effect on project performance. Relational trust is developed through

188   reciprocity and social-emotional exchange, which require a higher level of confidence in the

189   partner (Rousseau et al. 1998). Appropriate contractual control and contingency adaptability

190   give parties more confidence when sharing information within a BIM working environment,

191   since mutual interests are protected and uncertainties are reduced. Through promoting

192   information sharing and collective decision-making in a BIM environment, coordination and

193   contingency adaptability provisions foster relationships between parties. Several studies reveal

194   that trust is closely connected to project performance. For instance, interorganizational trust

195   has positive effects on cost performance improvement (Li et al. 2018). Furthermore, trust

196   moderates the relationship between manager relational exchanges and project performance

197   (Chen and Lin 2018). Trust also affects communication and, therefore, influences project

198   performance (Cheung et al. 2013). Hence, the following are hypothesized:

199   **H2:** Calculative trust has a positive influence on the relationship between joint-contract

200   functions and project performance.

201   **H3:** Relational trust has a positive influence on the relationship between joint-contract

202   functions and project performance.

203

204   *Mediating effect of interorganizational distrust*

205   Trust and distrust should be investigated separately since they are two distinct constructs

206   (Dimoka 2010). In this study, distrust refers to the state of being influenced by calculative

207   judgement. Contractual control allows for the easier identification of instances in which one or

208   the other party deviates from the contract terms. Thus, it supports the enforcement of

209   contractual terms (Lumineau 2017) and makes contracts more proficient in terms of the logical

210   judgements that motivate assumptions about the other party. Contractual controls also promote

211   calculative distrust. For example, calculative distrust can be associated with the following

212   scenarios: the protection of the intellectual property rights of BIM model contributors, auditing

213   a model to ensure the conformance of project deliverables, and stipulating damages arising

214   from the third party copyright infringement, among others. The contractual controls promote

215   calculative distrust—in other words, constructive skepticism and vigilance—safeguarding the

216   interests of both parties involved in the contractual relationship (Lumineau 2017). The

217   informed awareness that emerges from calculative distrust prompts the contracting parties to

218   take appropriate measures to mitigate risks (Smyth et al. 2010). In other words, trust and

219   distrust are simultaneously managed in this kind of antagonistic environment, in which parties

220   are as likely to distrust as they are to trust one another (Lewicki et al. 1998). This implies that

221   distrust may correlated with project performance, particularly if the parties experience

222   increased trust after a successful collaboration and transaction. Trust can positively affect a

223 transaction when fear and skepticism are minimized through appropriate distrust-related

224 contract provisions (Lee et al. 2018). Hence, the following is hypothesized:

225 **H4**: Calculative distrust has a positive influence on the relationship between joint-contract

226 functions and project performance.

227

228 *Multiple mediating effects of perceived fairness and interorganizational trust*

229 When the fairness principle is applied to construction projects, both parties in a contract

230 should hold equal positions for gaining economic advantage. When parties perceive there is

231 fairness in the transaction, they will exhibit positive behaviors that can improve project

232 performance, such as resolving problems collaboratively, working harmoniously, and engaging

233 in mutual support, all of which are essential for success in BIM-enabled projects (Lim and

234 Loosemoore 2017). Perceived fairness can reduce the potential for dissatisfaction and conflicts

235 and bolster the legitimacy of organizational procedures. In construction research, perceived

236 fairness has been shown to affect claims and disputes (Spittler and Jentzen 1992). In these

237 ways, perceived fairness affects the cooperative behaviors of employees and the operational

238 efficiency of firms (Greenberg 1989).

239 There are two types of perceived fairness that influence decision-making: distributional and

240 procedural fairness. To achieve distributional fairness, the material outcomes of a cooperative

241 effort must be compatible with the perceived outcomes (Adams 1965). Procedural fairness not

242 only pertains to material outcomes but also to the process used to reach those outcomes

243 (Leventhal 1980). Contract functions can affect both types of fairness. Contractual coordination

244 and contingency adaptability affects procedural fairness by specifying the ways in which

245 parties involved in BIM collaborate, such as in the strategic coordination of BIM development

246 in stages through mutual discussions and procedures to prevent conflicts from arising.

247 Procedural fairness can induce a broad range of emotions in employees, including the feeling

248   of being respected, feeling loyalty to and recognized by a company, feelings of trust, and work

249   commitment (Collet 2008). Contractual control, which stipulates damages from a breach of

250   terms in BIM delivery, affects distributional fairness, which in turn influences efficiency and

251   productivity (Suliman 2007). It may be difficult, however, to realize absolute fairness (Lau and

252   Rawlinson 2009). In light of the above discussion, the following are hypothesized:

253   **H5:** Perceived fairness and calculative trust jointly and positively influence the relationship

254   between joint-contract functions and project performance.

255   **H6:** Perceived fairness and relational trust jointly and positively influence the relationship

256   between joint-contract functions and project performance.

257

258   *Multiple mediating effects of perceived fairness and interorganizational distrust*

259   Perceived fairness also impacts the positive outcomes of calculative distrust through joint

260   contract provisions. For example, control provisions may include requirements for compliance

261   audits and for the payment of damages for copyright infringement. These provisions invoke

262   the distributional and procedural judgements of parties and motivate the careful monitoring of

263   activities during BIM use (Provan and Skinner 1989), and the scrutinizing of actions that

264   diverge from agreed-upon terms (Klein and Murphy 1988). Fairness plays an important role in

265   mediating joint-contract functions, thus encouraging the positive outcomes of distrust.

266   Specifically, fairness has to do with the way individuals are treated and the sense of justice that

267   comes from the sharing of rewards (Lau and Rawlinson 2009). When perceived fairness

268   influences distrust provisions, it may impact project performance. Therefore, the following is

269   hypothesized:

270   **H7:** Perceived fairness and calculative distrust jointly and positively influence the

271   relationship between joint-contract functions and project performance.

272

Research methodology

Data collection

To collect relevant data, the researchers approached approximately 1,200 construction-related practitioners worldwide via LinkedIn, most of them from oil and gas conferences and workshops. It took two years to collect the contact details of all the practitioners who were involved in planning, construction, engineering, contract, and information management of EPC oil and gas projects. This kind of project was selected for two reasons. First, oil and gas projects have exploited BIM for over 20 years. Second, the maturity of the BIM used in oil and gas projects made it easier to conduct an investigation to identify the impact of contract functions on BIM-enabled project performance, and EPC is one of the most popular project delivery methods used in oil and gas projects.

The survey, which consisted of four sections, was distributed to respondents, who answered questions based on their most recent projects. Section A of the survey inquired about the project and personal details. To help respondents understand and respond to the survey, BIM was referred to as three-dimensional (3D); four-dimensional (4D, Construction Sequencing); five-dimensional (5D, Cost Estimation); and six-dimensional (6D, Asset Lifecycle Management) modeling and its associated technologies; and/or digital data involved in the design, production, and maintenance process. Oil and gas projects were referred to as projects related to building facilities for oil, gas, and their derivatives (e.g., methanol, fertilizers). This included drilling and production platforms; floating production storage and offloading systems (FPSO); floating liquefied natural gas (FLNG); onshore oil and gas plants; and other related infrastructure (e.g., pipeline, jetty, and ship loading facilities). Sections B, C, and D comprised questions on the measurement items for the contract functions related to BIM, interorganizational trust and distrust, and project performance, respectively. Each variable consisted of four measurement items except for project performance, which consisted of seven measurement items. A two-

298   round pilot survey was conducted to validate and revise the draft questionnaire as required

299   (Jiang et al. 2016). In the first round, the questionnaire was distributed to three experts in oil

300   and gas contracts and engineering and project management, respectively. After revising the

301   questionnaire, it was sent to nine oil and gas project practitioners for further comments. The

302   questionnaire was then revised until it was suitable for online distribution, which took place

303   from May to July of 2018. The time frame given for responding to the survey was two weeks.

304   A follow-up reminder was sent five days before the response expiry date. In total, 276

305   responses were collected, with 2.6% of surveys having some missing values. Following the

306   assertion by Schafer (1999) that a missing rate of 5% or less is inconsequential, the

307   observations with missing data were removed from the dataset. After elimination, the sample

308   comprised 252 responses. Although the PLS-SEM algorithm has a bootstrapping feature to

309   deal with skewed data, Hair et al. (2014) suggested that the skewness and kurtosis of the data

310   should be + or -1. The data used for analysis in PLS-SEM that had a skewness exceeding 1

311   were transformed to ensure they fell within the limits of +1 or -1.

312

Data analysis method

314   PLS-SEM was used to determine the influence of joint-contract functions on project

315   performance and gauge any mediating effects on the relationship. This method was selected

316   for its precision in prediction-oriented analysis compared with covariance-based SEM (CB-

317   SEM) as well as for its ability to deal with complex models (Rigdon et al. 2017). Moreover,

318   the bootstrapping feature available in the PLS-SEM algorithm allowed for a more robust study

319   of skewed data and formative measures, as it transformed the data under the central limit

320   theorem (Ringle et al. 2009).

321

Sample data

323   Referring to Appendix 1, the respondents who worked with project owners represented 44%

324   of the sample and the EPC contractors, 56%. Most of the involved firms have operated for over

325   50 years, and their projects were mostly onshore plants and other associated facilities and in

326   Asia, North America, and Oceania. The contract values for most projects were above USD 500

327   million with durations of 2–5 years. Additionally, most respondents had more than 20 years of

328   working experience in the construction industry, as project managers (37%), contract managers

329   (13%), engineering managers (13%), construction managers (12%), information managers

330   (7%), project control managers (6%), and in other related roles (13%). Oil and gas projects

331   were found to fall significantly under the three-dimensional shared information model (40%),

332   with 32% of respondents stating that the shared information model used in the projects included

333   digital fabrication. Although 46% of respondents stated that the projects did not include other

334   BIM uses, 30%, 16%, and 8% of respondents mentioned the projects applied a four-

335   dimensional model for construction sequencing, a five-dimensional model for cost estimation,

336   and a six-dimensional model for asset lifecycle management, respectively.

337   To assess sampling error, the potential non-response bias was evaluated. Lindner et al.

338   (2001) suggested investigating this type of bias through an independent t-test to compare the

339   significant differences between early and late responses. As there is no consistent definition for

340   "late respondents," they were stipulated as those who answered the survey after receiving the

341   reminder email. The outcomes indicated no non-response bias, since the difference between

342   early and late responses was not significant. After cleaning the data, the authors examined

343   missing values using Little's missing completely at random test. The outcomes of the test

344   showed that the Chi-square was 48.405 with DF = 40 and Sig. = 0.170, which was not

345   significant. This suggested that missing values were random. The number of missing values

346   was 2.6%, where a 5% or lower missing rate was considered insignificant (Schafer 1999).

347   Hence, the observations with missing data were removed from the dataset.

348

Measures

The measurement items for contract functions were obtained from prior studies and BIM contract protocols. The respondents were given an opportunity to clarify any doubts before responding to the questions. Some items for contract functions may have looked similar but had different meanings. For instance, contractual control was measured by the specified contract terms that defined a right to audit for conformance in delivering BIM (*CON_1*) and stipulated damages against the party that failed to comply with the terms related to BIM deliverables (*CON_2*). Contractual control was also measured by general controlling and monitoring of BIM deliverables terms (*CON_3*), such as the requirements of contracting parties to deliver BIM as specified in the contracts, and the terms that specified solutions for non-conformance of BIM deliverables (*CON_4*). For *COR_4*, contractual coordination provided dispute resolution provisions for parties to achieve collective action to deal with the conflicts arising from delivering BIM, which is different from contractual control.

The measurement scales for project performance, perceived fairness, calculative trust, and relational trust in Table 1 draw from measurement scales validated in prior studies. Calculative distrust was measured following the literature (Lumineau 2017). All construct indicators were measured using 5-point Likert scales, ranging from strongly disagree to strongly agree or from extremely low to extremely high. Reflective constructs formed the indicators. All constructs were reflective, except for the joint-contract function, which was formative. Thus, the three contract functions—contractual control, coordination, and contingency adaptability—influenced the joint-contract functions. Although joint-contract functions were interpreted as formative constructs, they repeated the indicators in the three contract functions. Since joint-contract functions had a reflective measurement model, as in Figure 1, all relevant reliability and validity tests had to be cleared when measuring the reflective model, with the exception of

373   the discriminant validity between the three distinct and joint-contract functions (Hair et al.

374   2014).

375

376   **Results and data analysis**

377   SmartPLS 3.0 was used to analyze the measurement models and the structural model. The

378   assessment followed Hair et al. (2014).

379

380   *Evaluation of measurement models*

381   The indicators in a reflective construct must be consistent with each other within the

382   construct. To measure internal consistency reliability, the suggested Cronbach's alpha's value

383   should range from 0.70 to 0.90 (DeVellis 2016) to demonstrate the intercorrelations of a set of

384   items. Table 2 shows that all Cronbach's alpha values are below 0.90, except for joint-contract

385   functions, which had a value of 0.927. However, it is less accurate to assess internal consistency

386   reliability using this measure, as it is responsive to the number of items measured on a scale

387   (Hair et al. 2014). Composite reliability (CR) is a more reliable internal consistency measure.

388   It considers the different outer loadings of indicators, measurement errors of the indicators, and

389   their variances. Table 1 shows that all constructs had CR values below the 0.95 threshold (Hair

390   et al. 2014). All outer loadings of indicators were above the 0.70 threshold, except for the

391   contractual control that stipulated damages against the party failing to deliver the digital model

392   and/or data, with the value of 0.609 in the joint-contract functions construct. This control was

393   removed from the model. The values of the outer loadings of contractual control defined the

394   right to audit for conformance in delivering the digital model and/or data in the joint-contract

395   functions construct; the distrust construct, in which one party was constructively skeptical

396   about the other party, enabled better work in the project; project performance constructs, which

397   indicated the outcome of the project, added value to the organization's operations; and the

398   project satisfying health and safety performance expectations were also below the threshold, at

399   0.672, 0.673, 0.686, and 0.649 respectively. Nevertheless, indicators with outer loading values

400   ranging from 0.40 to 0.70 should be removed if removal increases the value of CR or the

401   average variance extracted (AVE) (Hair et al. 2014). The deletion of these indicators reduced

402   the CR value; hence, they were retained in the model. Simultaneously, AVE was used to assess

403   the extent to which an indicator correlated positively with other indicators of the same construct

404   (Hair et al. 2014). The values of the AVEs of all constructs were above the 0.50 threshold,

405   demonstrating that the indicators in the constructs converged.

406   Discriminant validity is another important measure that analyzes the differences between

407   constructs. This measure shows a construct is distinguished from other constructs in a model

408   and captures a different phenomenon. In PLS-SEM, the heterotrait-monotrait ratio (HTMT) of

409   correlations is a new measure that assesses discriminant validity, as the Fornell–Larcker

410   criterion and cross-loadings do not detect discriminant validity reliably in some situations

411   (Henseler et al. 2015). Table 3 shows the HTMT value between contractual coordination and

412   contingency adaptability is 0.950. Henseler et al. (2015) suggested that indicators with low

413   correlations should be removed to reduce HTMT values. Hence, the lowest outer loading values

414   for contractual coordination (which delegates the roles of parties for delivering BIM and

415   provides dispute resolution provisions to deal with any conflicts) were removed (Table 2),

416   which reduced the HTMT value to 0.885.

417

418   ***Common method variance***

419   The evaluation of common method variance is important since it influences the validity and

420   reliability of measurement models (Podsakoff et al. 2003). This type of systematic error occurs

421   when a single source of research design is used (Schaller et al. 2015). This study may be

422   affected by common method variance, as the data were collected through a single source, that

423   is, an online survey. Harman's (1976) single-factor test is a common method used to assess

424   variance. The result of the analysis showed a variance of 24.13%, meaning that it was unlikely

425   the common method variance affected the study outcomes (Podsakoff and Organ 1986). The

426   full collinearity test is a reliable method proposed by Kock (2015) to determine common

427   method variance in PLS-SEM research. The accepted criterion for variance inflation factor

428   (VIF) values is that it should not be above 3.3 when using the PLS-SEM algorithm (Kock

429   2015). The test in this study showed that all VIF values of the constructs were below 3.3,

430   indicating no common method variance.

431

432   *Structural model evaluation*

433   To examine the structural model, Stone-Geisser's Q^2 value was calculated to evaluate the

434   predictive relevance of indicators. All constructs had positive Q^2 values (calculative trust =

435   0.081; calculative distrust = 0.041; relational trust = 0.137; perceived fairness = 0.055; joint-

436   contract functions = 0.569; and project performance = 0.11), indicating the predictive relevance

437   of the path model for the constructs. Next, the coefficient of determination (R^2 value) was used

438   to assess the predictive accuracy of the model. R^2 values range from zero to one. The higher

439   the R^2 value, the higher the predictive accuracy. In research related to predicting the drivers of

440   success, an R^2 value of 0.20 is considered high (Hair et al. 2014). In this study, project

441   performance had the highest R^2 value (0.233), followed by relational trust (0.225), calculative

442   trust (0.150), calculative distrust (0.098), and perceived fairness (0.092). In addition to the

443   evaluation of R^2 values, the effect size f^2 was used to evaluate the substantive impact of a

444   variable when removed from the model.

445   The small, medium, and large effect sizes were represented by the f^2 values of 0.02, 0.15,

446   and 0.35 respectively (Cohen 1988). Table 4 shows that all exogenous variables had at least

447   small effects on the endogenous variables, except for calculative distrust on project

448   performance and joint-contract functions on calculative trust and project performance, with f^2

449   values of 0.000, 0.010, and 0.009, respectively. Comparing the f^2 values of the variables shows

450   that relational trust and perceived fairness were the endogenous variables in the model.

451   Relational trust was affected by both perceived fairness (medium effect, f^2=0.165) and joint-

452   contract functions (small effect, f^2=0.046), whereas perceived fairness was solely affected by

453   joint-contract functions (small effect, f^2=0.102). Calculative trust was partially endogenous, as

454   it was affected by perceived fairness (small effect, f^2=0.127) but not joint-contract functions.

455   The constructs' path coefficients were then analyzed. Bootstrapping was conducted for

456   5,000 iterations to identify the t-values, p-values, and confidence intervals of the paths

457   (Palanski et al. 2011). Table 5 shows that, although the direct effect between joint-contract

458   functions and project performance is 0.09 and the p-value is not significant, the joint-contract

459   functions had a significant total effect ($\beta = 0.227$, $p < 0.01$) and indirect effect ($\beta = 0.136$, $p <$

460   0.01) on project performance. Hence, **H1 is partially supported.** Table 4 also shows that there

461   was no significant effect of calculative trust on joint-contract functions and project

462   performance ($\beta = 0.230$, $p > 0.10$); therefore, **H2 is not supported.** In contrast to calculative

463   trust, relational trust was a significant mediator variable between joint-contract functions and

464   project performance ($\beta = 0.058$, $p < 0.01$), showing that **H3 is supported.** The results in Table

465   5 also show that calculative distrust insignificantly influenced the relationship between joint-

466   contract functions and project performance ($\beta = 0.001$, $p > 0.10$). Hence, **H4 is not supported.**

467   In terms of multiple mediation effects, **H5 is supported**. Perceived fairness and calculative

468   trust jointly influenced joint-contract functions and project performance ($\beta = 0.023$, $p < 0.10$).

469   **H6 is also supported,** since perceived fairness and relational trust jointly influenced joint-

470   contract functions and project performance ($\beta = 0.031$, $p < 0.05$). However, **H7 is not**

471   **supported**, as perceived fairness and calculative trust did not jointly mediate contract functions

472 and project performance ($\beta = 0.000$, $p > 0.10$). Figure 2 shows the final model for joint-contract

473 functions and project performance.

474

475 **Moderating effects analysis**

476 To determine whether the relationships in the structural model were influenced by different

477 project scopes and types, a moderating effects analysis was conducted with the finding that

478 relationships between constructs in the model were not influenced by scopes (e.g., FPSO,

479 FLNG, and other plants) and types of projects (locations, values, and durations) with the

480 exception of the paths in Table 6.

481 Table 6 and Figure 3 show that the positive relationship between joint-contract functions

482 and relational trust was stronger for projects located onshore but the relationship turns negative

483 for the projects located offshore. The relationship between joint-contract functions and

484 calculative distrust was positive for both low and high contract values. This relationship was

485 stronger for projects with higher value. Project duration moderated the relationship between

486 calculative distrust and project performance such that for shorter project durations, the effect

487 was negative, and for longer project durations, it was positive. By contrast, the relationship

488 between joint-contract functions and project performance was stronger for projects with a

489 longer duration but weaker when the project duration was shorter.

490

491 **Discussion and contributions**

492 *Joint-contract functions and the mediating effect of relational trust*

493 The results above provide new insights, including the observation that joint-contract

494 functions indirectly influence BIM-enabled EPC project performance through perceived

495 fairness and relational trust; this is despite the fact that the effects of joint-contract functions

496 on relational trust are not so pronounced in offshore projects. The results are different from

497   prior research in that formal contracts tend to restrain the establishment of relational norms

498   between contracting parties (Malhotra and Murnighan 2002). The outcomes of this study

499   explain how joint-contract functions can be used as a complementary approach to EPC BIM-

500   enabled projects, an area hitherto not empirically examined. The moderation analysis shows

501   that, when the EPC project duration is longer, the relationship between joint-contract functions

502   and a BIM-enabled project performance is stronger. These outcomes suggest that the

503   conventional approach of EPC contracts that focused on imposing contractual obligations to

504   safeguard transactions is no longer an effective governance method for long-term BIM-enabled

505   projects. In a BIM working environment, enhancing contractual coordination and contingency

506   adaptability, in addition to formal control, has implications on relational development and,

507   thereby, leads to EPC project success. These functions include providing operational

508   coordination for parties to discuss the necessary adjustments that need to be made to the BIM

509   model upon the completion of the model review, redefining the specific objectives of the BIM

510   model through mutual discussions upon the completion of the first-stage model development,

511   and achieving collective action for handling unforeseen circumstances that may involve BIM.

512   For EPC project success, construction contracting parties should view formal contracts as a

513   mechanism to achieve a shared purpose instead of a tool that solely protects their benefits and

514   interests. Focusing on contractual coordination in BIM model development and on contingency

515   adaptability for joint problem solving enables parties to implement BIM with dynamic

516   efficiency and embed relational elements into the BIM working environment.

517

518   *Perceived fairness as a cornerstone of joint-contract functions*

519   Although Lumineau (2017) proposed that excessive contract functions may have negative

520   effects on calculative and non-calculative trust, there is no study on how the extent of contract

521   functions influences trust. This study shows that perceived fairness influenced the degree of

522   calculative and relational trust and impacted EPC project performance positively and

523   significantly. This suggests that an adequate level of joint-contract functions could be

524   determined through the perceived fairness of both parties. This outcome broadens the views of

525   EPC practitioners and suggests looking beyond the traditional EPC contract setting. Contracts

526   that promote joint problem solving and fair risk allocation would clearly provide a team-

527   building platform and help cultivate rapport between contracting parties (Cheung et al. 2009).

528   Hence, EPC contracts should not be framed solely to benefit the client. Contracting parties

529   should consider the fairness of terms when devising BIM-related contract provisions to

530   maximize the potential for project success. For instance, EPC contractors should not be held

531   responsible for the failure to deliver BIM, which may be outside their control, and appropriate

532   time extensions should be granted so that contractors can rectify these errors or issues.

533

534   ***Distrust does not necessarily negatively impact project performance***

535   This study also reveals a new perspective on distrust in terms of BIM-enabled EPC project

536   performance. It is commonly believed that formal contracts increase partner distrust and in

537   turn, induce non-cooperative behaviors (Wu et al. 2017). While joint-contract functions have a

538   significant effect on calculative distrust (which does not warrant its significant effect on EPC

539   project performance) the results demonstrate that they may not necessarily have negative

540   implications for EPC project performance. The relationship between joint-contract functions

541   and project performance is stronger when project duration is longer and contract value is

542   higher. This substantiates the fact that calculative distrust in EPC projects is necessary to

543   prevent knowledge leaks, support vigilance, and promote healthy suspicion and constructive

544   skepticism against the other party's opportunistic behaviors, all of which can boost confidence

545   and help both parties to perform better in BIM-enabled projects. Examples of functions that

546   can have these effects include defining the right to audit for conformance in delivering BIM,

547 controlling and monitoring BIM deliverables, and providing resolutions for non-compliance

548 with the terms and conditions of delivering BIM.

549

550 ***Effective collaboration among project participants without altering existing EPC contract***

551 ***structure***

552 Finally, the mediation effects of interorganizational trust between joint-contract functions

553 and BIM-enabled EPC project performance demonstrate not only that owners and EPC

554 contractors should collaborate more intensively to build trust but also that other project

555 stakeholders with direct contractual relationships (such as specialist contractors and

556 subcontractors) should be involved directly in the collaboration process. For example, as per

557 Figure 4, the EPC project network is egocentric. Only the EPC main contractor plays a

558 prominent role in communicating between owners and other project participants. The owner

559 and other project participants are peripheral nodes in the project networks, and they depend on

560 the main contractor to deliver and receive information. This practice is fragmented, as each of

561 the project participants follows their own procedures (Fakhimi et al. 2017), and it increases

562 asymmetric information and opportunistic behaviors (You et al. 2018). In fact, all project

563 stakeholders are required to share and receive project information through a unified

564 information model. There is very little trust involved at the beginning of projects, but social

565 exchange relationships emerge as each party proves its trustworthiness. During the information

566 sharing process, as the parties engage more deeply in EPC projects (Shapiro 1987), relational

567 norms are established. As such, stakeholders in BIM contracts within EPC projects should

568 strive to harmonize relationships with other stakeholders in both their formal and informal

569 social networks. Ultimately, this will foster an effective and collaborative BIM work

570 environment.

571

572   *Limitations and future research directions*

573   The current study has certain limitations. The PLS-SEM method used here is exploratory

574   and different from CB-SEM. The CB-SEM approach uses strict measures of confirmatory

575   factor analysis to validate a developed theory, while this study uses PLS-SEM for exploration

576   and prediction. Additionally, the use of contract functions may be affected by the levels of BIM

577   use in a project. As such, the results of this study may be influenced by BIM use levels, since

578   BIM uses may vary by project.

579   There are several antecedents of joint-contract functions—such as BIM asset specificity,

580   behavioral uncertainty, and environmental uncertainty—which require attention, as the extent

581   of joint-contract functions that influence interorganizational trust may be affected by BIM

582   transaction attributes. Further, interorganizational trust predecessors, such as communication

583   and reciprocity, may strengthen the relationship between joint-contract functions and

584   interorganizational trust. If the influences of these predecessors are empirically proven, then

585   when devising BIM-related provisions, appropriate strategies should be considered to enhance

586   these factors to optimize the influence of joint-contract functions on BIM-enabled project

587   performance.

588   Since the model is an aggregate of three different contract functions (joint-contract

589   functions) in a BIM-enabled EPC project setting, the effect of the individual functions on EPC

590   project performance was not identified. For instance, the contract that specified the right to

591   audit for compliance while delivering BIM may impact perceived fairness (procedural fairness)

592   positively for one party but may induce distrust for the other party. How this contract function

593   translates into project performance is not clear. Future research on the model should investigate

594   the perspectives of both contracting parties and identify ways to achieve optimal trust between

595   parties during the development of BIM-related contracts. Additionally, industry norms and

596   standard contract provisions, which may have implications for the model beyond the scope of

597   this research, also require further investigation.

598   Although the study has successfully shown the mediating effects of interorganizational trust

599   and distrust in the relationship between joint-contract functions and BIM-enabled EPC project

600   performance, future studies should determine how contract functions influence trust among

601   project stakeholders through a comprehensive social network analysis. Through investigating

602   formal and informal collaborative relationships using social network analysis, researchers

603   could assess the dynamic evolution of interorganizational trust among project participants

604   during BIM-enabled project implementation (Lee et al. 2017).

605

606   **Conclusions**

607   This study has determined the direct and mediating effects of joint-contract functions and

608   BIM-enabled EPC project performance through PLS-SEM. The research outcomes have

609   demonstrated that relational trust has a positive influence on the relationship between joint-

610   contract functions and EPC project performance. It also showed that, while calculative trust

611   may not significantly mediate the relationship between joint-contract functions and EPC

612   project performance, its impacts are more pronounced in terms of perceived fairness. This

613   suggests that joint-contract functions may influence interorganizational trust for BIM-enabled

614   EPC project performance improvement when fairness is perceived. Moreover, the study

615   demonstrated that the calculative distrust influenced by the joint-contract functions may not

616   necessarily have negative implications for project performance. In other words, calculative

617   distrust arising from joint-contract functions may not be detrimental to EPC project

618   performance and is an important element in BIM-enabled projects. The examinations of the

619   effects of joint-contract functions on BIM-enabled EPC project performance and their

620   mediating effects have provided valuable insights for relevant industries, showing mainly that

621 BIM can be implemented effectively within a traditional EPC contract setting. The current

622 findings contribute to knowledge development of appropriate contract framing for BIM-

623 enabled EPC project stakeholders, an area not discovered in the previous literature. However,

624 for this complementary approach to be used effectively in EPC projects, certain changes should

625 be made to contracts to influence interorganizational trust, distrust, and perceived fairness

626 between owners and EPC contractors. This approach will maximize the potential for EPC

627 project success.

628

629 **Data Availability Statement**

630 All data generated or analyzed during the study are included in the submitted article and

631 supplemental data file.

632

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637

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Table 1. Measurement of key constructs

No.	Variables/ Code	Reflective Measurement Items	Modified from Referred Sources
1	**Contractual Control (CON)**		
	CON_ 1	The contract specified right to audit for compliance with the creating, using and maintaining BIM.	Lumineau and Henderson (2012)
	CON_ 2	The contract stipulated damages against the party which failed to conform to the obligations of creating, using and maintaining BIM.	Lumineau and Henderson (2012)
	CON_ 3	The contract provided provisions for controlling and monitoring BIM deliverables.	Lumineau and Henderson (2012)
	CON_ 4	The contract specified resolution for nonconformance to the terms and conditions of creating, using and maintaining BIM.	Lumineau and Henderson (2012)
2	**Contractual Coordination (COR)**		
	COR_ 1	The contract delegated duties to create, use and maintain BIM.	Lumineau and Henderson (2012)
	COR_ 2	The contract provided operational coordination for parties to discuss the necessary adjustments that need to make on BIM upon completion of the model review.	Lumineau and Henderson (2012)

COR_ 3	The contract provided strategic coordination for parties to sharpen the second-stage specific objectives of BIM development through mutual consultations after completion of the first-stage BIM development.	Lumineau and Henderson (2012)
COR_ 4	The contract provided dispute resolution provisions to deal with the conflicts arising from developing, using and maintaining BIM.	Lumineau and Henderson (2012)

3 Contingency Adaptability (COA)

COA_ 1	The contract provided provisions that required revisions/updates of BIM in conjunction with the variations/changes to the works.	Wang et al. (2017)
COA_ 2	The contract provided principles or guidelines for handling unforeseen circumstances arising from developing, using and maintaining BIM.	Wang et al. (2017)
COA_ 3	The contract provided solutions for responding to various contingencies arising from developing, using and maintaining BIM.	Wang et al. (2017)
COA_ 4	The contract specified procedures for changes made in BIM.	Quanji et al. (2016)

4 Calculative Trust (CAL)

CAL_ 1	Considering risks and rewards, we believed the other party would behave honestly in dealing with us.	Poppo et al. (2016)

CAL_ 2	Taking into account the high cost of misconduct, we believed the other party would behave trustworthily in performing the works.	Poppo et al. (2016)
CAL_ 3	We believed the other party would act professionally and competently in performing the works.	Poppo et al. (2016)
CAL_ 4	We expected the relationship with the other party would continue for a long time.	Wu et al (2017)

5 Relational Trust (REL)

REL_ 1	Both of us were confident that our interests would be protected because we shared a common identity.	Poppo et al (2016)
REL_ 2	We believed the other party would act effectively for us because we shared the same understanding of what matters.	Poppo et al (2016)
REL_ 3	We believed the other party would be willing to share information with us given that both of us shared the common objectives.	Poppo et al (2016)
REL_ 4	Both of us would be willing to look for a joint solution to a problem arising in the project because we shared the common objectives.	Poppo et al (2016)

6 Calculative Distrust (DIS)

DIS_1	We believed monitoring of vulnerabilities (e.g. potential leakage of valuable knowledge) would safeguard our interest in the project.	Lumineau (2017)
DIS_2	We believed healthy suspicion of the other party would protect us against potential opportunism.	Lumineau (2017)
DIS_3	We supported vigilance against the other party.	Lumineau (2017)
DIS_4	We believed constructive scepticism of the other party enabled us to work more confidently in the project.	Lumineau (2017)

7 Perceived Fairness (PF)

PF_1	Our remuneration was commensurate with our ability, effort, input, and experience.	Lim and Loosemore (2017)
PF_2	We were provided with adequate resources to execute our work effectively.	Lim and Loosemore (2017)
PF_3	The risks that we were required to bear were equitable and commensurate with our capability to cope with them.	Lim and Loosemore (2017)
PF_4	We were paid equitably for the job that we completed.	Lim and Loosemore (2017)

8 Project Performance (PP)

PP_1	In general, the project team members were very satisfied with their work.	Thompson et al (2007)
PP_2		

	The project outcome added value to the business operations of our firm.	Thompson et al (2007)
PP_3	The rate of the project met the schedule as compared to other projects.	Thompson et al (2007)
PP_4	The rate of the project met the budget as compared to other projects.	Thompson et al (2007)
PP_5	The rate of the project met the quality of the produced work as compared to other projects.	Thompson et al (2007)
PP_6	The rate of the effectiveness of team members' interactions as compared to other projects.	Thompson et al (2007)
PP_7	The rate of the project met the health and safety expectations as compared to other projects.	Suprapto et al. (2016)

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Table 2. Results summary of reflective measurement models

Variables	Indicators	Outer Loadings	Cronbach alpha	Composite Reliability (CR)	AVE
Contractual Control (*CON*)	*CON_ 1*	0.801	0.823	0.883	0.653
	CON_ 3	0.841			
	CON_ 4	0.842			
Contractual Coordination (*COR*)	*COR_ 2*	0.864	0.831	0.888	0.665
	COR_ 3	0.821			
Contingency Adaptability (*COA*)	*COA_ 1*	0.818	0.857	0.903	0.699
	COA_ 2	0.834			
	COA_ 3	0.840			
	COA_ 4	0.852			
Joint Contract Functions (*FUNC*)	*CON_ 1*	0.672	0.927	0.937	0.556
	CON_ 3	0.766			
	CON_ 4	0.770			
	COR_ 2	0.779			
	COR_ 3	0.763			
	COA_ 1	0.785			
	COA_ 2	0.768			
	COA_ 3	0.754			
	COA_ 4	0.793			
Calculative Trust (*CAL*)	*CAL_ 1*	0.767	0.777	0.857	0.601
	CAL_ 2	0.779			
	CAL_ 3	0.843			

	CAL_ 4	0.704			
Relational Trust (REL)	REL_ 1	0.798	0.811	0.876	0.639
	REL_ 2	0.858			
	REL_ 3	0.801			
	REL_ 4	0.736			
Calculative Distrust (DIS)	DIS_ 1	0.793	0.745	0.824	0.540
	DIS_ 2	0.751			
	DIS_ 3	0.718			
	DIS_ 4	0.673			
Perceived Fairness (PF)	PF_ 1	0.734	0.795	0.867	0.620
	PF_ 2	0.819			
	PF_ 3	0.776			
	PF_ 4	0.818			
Project Performance (PP)	PP_ 1	0.729	0.840	0.879	0.509
	PP_ 2	0.686			
	PP_ 3	0.725			
	PP_ 4	0.708			
	PP_ 5	0.758			
	PP_ 6	0.735			
	PP_ 7	0.649			

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Table 3. Heterotrait-Monotrait Ratio (HTMT)

	CAL	COA	CON	COR	DIS	PF	PP	REL
CAL								
COA	0.255							
CON	0.144	0.838						
COR	0.255	**0.950**	0.847					
DIS	0.257	0.285	0.248	0.269				
PF	0.472	0.377	0.295	0.291	0.317			
PP	0.510	0.255	0.166	0.233	0.196	0.694		
REL	0.859	0.379	0.219	0.392	0.352	0.536	0.536	

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Table 4. Effect size f^2

	CAL	DIS	PF	PP	REL
CAL				0.030	
DIS				0.000	
FUNC	0.010	0.028	0.102	0.009	0.046
PF	0.127	0.048			0.165
PP					
REL				0.047	

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Table 5. Direct effect, total effect and indirect effect of relevant paths

Hypothesis	Coeff.	T value	Significance level	p value	Confidence intervals	
					Lower Bound (5%)	Upper Bound (95%)
Direct effect						
H1: *FUNC -> PP*	0.090	1.414	ns	0.157	-0.013	0.196
Total effect						
H1: *FUNC -> PP*	0.227	3.215	***	0.001	0.117	0.349
Indirect effect						
H1: *FUNC -> PP*	0.136	3.970	***	0.000	0.087	0.199
H2: *FUNC -> CAL -> PP*	0.230	1.142	ns	0.253	-0.001	0.062
H3: *FUNC -> REL -> PP*	0.058	2.668	***	0.008	0.025	0.096
H4: *FUNC -> DIS -> PP*	0.001	0.083	ns	0.934	-0.019	0.022
H5: *FUNC -> PF -> CAL -> PP*	0.023	1.720	*	0.085	0.006	0.049
H6: *FUNC -> PF -> REL -> PP*	0.031	2.505	**	0.012	0.013	0.055
H7: *FUNC -> PF -> DIS -> PP*	0.000	0.081	ns	0.935	-0.006	0.010

822   Note: *, **, *** and ns indicate a significance level of p<0.1, p<0.05, p<0.01 and no significance, respectively based

823   on bootstrapping of 5,000 subsamples.

Table 6. Moderation effects of relevant paths

Path	Moderator	Coeff.	t value	Significance level	p value	Confidence Interval	
						Lower Bound (5%)	Upper Bound (95%)
FUNC -> DIS	Contract value	0.081	2.549	**	0.011	0.043	0.129
FUNC -> REL	Project location	-0.400	2.234	**	0.026	-0.072	0.635
FUNC -> PP	Project duration	0.251	2.406	**	0.017	0.108	0.400
FUNC -> DIS	Project duration	0.296	3.350	***	0.001	0.178	0.456