

Exploring strategies to reduce moral hazard and adverse selection of Ghanaian Public-Private-Partnership (PPP) Construction Projects

Abstract

Purpose: Conditions of inadequate and asymmetric information when an agent is hired by a principal have resulted in the problems of moral hazard and adverse selection (MHAS) in Public Private Partnership (PPP) construction projects. The objective of this study was to explore strategies to reduce moral hazard and adverse selection in PPP construction projects.

Design/methodology/approach: Questionnaires were used to elicit responses from respondents. Mean score ranking was used to rank these strategies while reliability analysis was conducted using Cronbach Alpha coefficient and level of agreement tested using Kendall's concordance. Factor analysis grouped the strategies into eight components.

Findings: From the mean score ranking, Monitoring; Transfer of risks; Screening; Managing of construction risks; and Increased incentives to control costs were the most significant strategies. The eight components were: Transparent process and contract; Incentives and monitoring; Screening and technical assistance; Unbundling and benchmarking; Funding and small liabilities; Information clarification and signalling; Risk and contract management; and Cooperation and finance factors.

Practical implications: The findings of this have identified the most significant strategies to reduce MHAS on PPP construction projects to serve as a guide to PPP practitioners in reducing MHAS.

Originality/value: The output of this research contributes to the checklist of strategies that reduce PPP project failures arising from MHAS and contributes to the development of the agency theory.

Paper Type - Research paper

Keywords Strategies, moral hazard, adverse selection, Public-Private-Partnership, construction projects

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31 INTRODUCTION

32 Moral hazard is the situation of information unevenness or asymmetry that happens after the
33 principal takes a decision (Owusu-Manu *et al.*, 2018a). On the other hand, this is called
34 hidden action because the actions and activities of the agent are not fully exposed to the
35 principal (Pana, 2010). Correspondingly, within the extant literature, adverse selection is
36 recognized to be the sole or private information possessed by the contractor and which is not
37 available to buyer (Biong, 2013). In adverse selection, information gap occurs preceding the
38 principal making his decision. This phenomenon is also referred to as hidden knowledge.
39 This is due to the potential agent having information which the principal lacks and thus
40 leading to the principal making a wrong decision.

41 The agency problem is a conflict of interest inherited in any relationship where one party is
42 expected to act in another's best interests (Lobner, 2009; Buvik and Rokkan, 2003). Agency
43 theory is concerned with resolving problems that exist in agency relationships due to
44 unaligned goals or different aversion levels to risk. The most common agency relationship in
45 constructions occurs between principals (clients) and agents (contractors) (Iossa and
46 Martimort, 2008).

47 Public-Private-Partnerships date back to the twelfth century (Wettenhall, 2010; Owusu-Manu
48 *et al.*, 2017). According to Bovaird (2010), in traditional procurement in the public sector, the
49 government is responsible for settling on design and specifications of the facilities. After the
50 bidding process, a private sector contractor is paid to construct the project (Ismail, 2013).
51 Despite controversies about PPP policy in developing countries, many developing countries
52 actually have huge infrastructure deficit and excessive government debts which in a way has
53 led to poor economic development and lower standards of living (Osei-Kyei and Chan,
54 2017a). This serves as an incentive for PPP to be explored in these nations to augment
55 infrastructure development and boost the living standards of citizens (Osei-Kyei and Chan,

56 2015; Kumar *et al.*, 2018). Owusu-Manu *et al.* (2018b) stated that MHAS was one of the
57 major challenges affecting PPP construction projects in developing countries; and their study
58 went ahead to explore a number of negative effects of MHAS. McCann *et al.* (2015) in their
59 study too established that MHAS was a challenge in Australian PPP projects and PPP
60 projects' failure to meet delivery outputs' minimum requirements.

61 Like other governments, the Government of Ghana (GoG) has also shown great interest in the
62 PPP concept, particularly for construction projects (Osei-Kyei and Chan, 2017b). Since 2004,
63 few construction PPP projects in Ghana have been initiated with many of the projects failing
64 to proceed successfully due to a number of reasons including moral hazard and adverse
65 selection (Osei-Kyei and Chan, 2017b; Owusu-Manu *et al.*, 2018b). In Ghana, the Ghana
66 National Housing Project (GNHP), which was the first ever major PPP housing project to be
67 initiated in the country's housing sector failed due to the problems of MHAS (Osei-Kyei *et*
68 *al.*, 2019).

69 There has been theoretical development over the recent years in researching on the problems
70 of moral hazard and adverse selection. However some gaps do exist in their literature since
71 there is dearth and scarcity of literature in these areas especially in strategies to reduce
72 MHAS in PPP construction projects. This study not only extends existing work but also
73 identifies and ranks significant strategies to reduce MHAS in PPP construction projects.

74 Practically, the identified and prioritized strategies will serve as a guide and managerial
75 support in future PPP projects. As such, the findings of the research may guide construction
76 stakeholders in reducing failure of PPP projects due to MHAS. These stakeholders and
77 practitioners will improve project success by recognizing and planning against failure of
78 these PPP projects.

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81 **LITERATURE REVIEW**

82 **Public Private Partnerships (PPP)**

83 PPP refers to ways of collaboration between public and private stakeholders which purposes
84 to guarantee the financing, building, refurbishing, administration or preservation of a service
85 or an infrastructure (Torres and Pina, 2001). Public-Private-Partnerships are carried out in
86 countless diverse sectors, for example: transportation, residential facilities, metropolitan
87 development, municipal renaissance, operating institutions of culture, educational areas.

88 In a study by Budäus and Gründing (1997), Public-Private-Partnership is characterized in a
89 smaller way by:

- 90 ➤ Relations among government and private stakeholders
- 91 ➤ Placing emphasis on accomplishment of similar objectives
- 92 ➤ Probability of synergy by way of mutual aid
- 93 ➤ Orientation of process
- 94 ➤ The associate's distinctiveness and conscientiousness
- 95 ➤ Stipulation of cooperation relationship

96 Due to the extended contract period (around thirty years), it is not feasible to lay down the
97 exact privileges, risks, rights, expenditures, accomplishments and liabilities in advance
98 (Budäus, 2006).

99 **Moral hazard and Adverse Selection (MHAS) in PPP construction projects**

100 A moral hazard problem arises when the agent's action is not verifiable, or when the agent
101 receives private information after the partnership has been commenced (Owusu-Manu *et al.*,
102 2018a). Moral hazard should not pose as a challenge or problem if both the principal and
103 agent had the same objective functions. The misunderstanding about which action should be
104 taken out is the basis for agency costs (Lobner, 2009).

105 An adverse selection problem happens when the agent holds private information before the
106 relationship begins (Owusu-Manu *et al.*, 2018a). The principal will be able to authenticate the
107 agent's behavior; however, the optimal decision, the cost of this decision relies on the agent's
108 type which is private information to the agent. The principal is aware that the agent is one of
109 several possible types but he/she cannot identify it (Lobner, 2009).

110 The two information problems do not exist disjoint, on the whole. This is as a result of the
111 existence of synergies between stages of the venture, accounting for why different tasks are
112 bundled in a distinct activity and delegated to a sole responsible private firm. The effort that
113 the firm exerts at the construction stage influences the circumstances it encounters at the
114 operation stage. For example, exerting effort might enhance the chance of encountering a
115 high demand for the service (since the infrastructure is more dependable) or a reduced price
116 of production (since the cost is an internal attribute of the project).

117 **Impact of MHAS on PPP construction projects**

118 Being a long term and global contract, the partnership contract enhances the traditional issues
119 of MHAS related to the choice of a bidder. It implies high transaction costs for both the
120 public and private partners, due to duration of the negotiation and the skills and resources
121 involved (Allen, 2003). The requirements of the contract are generally complex and
122 expressed in terms of outputs rather than inputs. MHAS selection in PPPs raise transaction
123 costs because the government has to negotiate with and monitor the private sector partners
124 who have their own interests and agendas.

125 The widespread problem of MHAS in the construction market are the main reason for the
126 dishonesty of the construction market and is the primary cause of the construction project risk
127 as well (Akintayo, 2018). If the problem of adverse selection cannot get effective settled, it
128 will be difficult to form a "win-win" situation in the construction market, which leads to the
129 harmonious project management being not formed.

130 The problem of adverse selection is particular prominent in domestic construction market.
131 Each contractor's strength level is uneven, which is the fundamental cause of adverse
132 selection. Because of asymmetric information, the owner has little or false information of the
133 contractor's technology, management, credit etc., leading to the owners tend to be at a
134 disadvantage position in the game of both sides, which leads to adverse selection –that is
135 "bad money drives out good money" Problems resulting from MHAS in PPP projects are
136 economic disadvantages for one of the parties, the inefficient use of resources, and the
137 resulting losses of welfare.

138 **Strategies to reduce moral hazard and adverse selection in PPP construction projects**

139 *Transfer of risk* by way of enforceable contracts curtails greatly the problems of moral hazard
140 and adverse selection (Akintayo, 2018). Simply put, transfer of construction risk results in
141 projects where only the most qualified builders have to control their own construction
142 liabilities and risks (Blanc-Brude, 2013). *Increased incentives to control costs*: Selecting
143 most qualified construction companies coupled with the incentive to manage costs restricts
144 moral hazard and adverse selection (Blanc-Brude, 2013). A fraction of construction risk
145 existent in infrastructural projects is a product of who is exposed to the risk (Laffont and
146 Tirole, 1993).

147 *Managing of construction risks*: Construction risks are controlled by way of a network of
148 contracts (Gatti, 2013) and transferred to construction companies which efficiently make
149 available insurance against unanticipated construction costs (Owusu-Manu *et al.*, 2018b).

150 *Benchmarking*: Asymmetries of information on the operating costs can also be reduced
151 through benchmarking and market testing processes (yardstick competition) (Kumar *et al.*,
152 2018). Elementary parts of the service provided by the contractor can be periodically
153 evaluated against market prices (Bureau and Mougeot, 2007).

154 *Financial unbundling:* Financial unbundling is an effective way of ensuring transparency in
155 projects by inducing a disclosure of the contract financial main points. The commitment of
156 financial institutions into the contract allows, the assessment of the completion of value for
157 money and reinforces, and the monitoring upon the special purpose entity (SPE) (Gatti,
158 2013).

159 *Bond spread:* An inadequate risk transfer to the contractor can be discovered by the
160 reasonability of the bond spread (Ameyaw and Wilhelm, 2017). For instance, if the public
161 partner takes on almost all the demand risk, it can be, in financial expressions, like providing
162 to the contractor an advance contract for free (Välilä, 2005).

163 *External finance:* External finance brings about a new agency relationship to the contract
164 (Gatti, 2013). It is positive to the public contractor since the interests of external financiers
165 are similar to its objective. In this way, part of the monitoring expenses can be externalized
166 (Blanc-Brude, 2013). *Funding competition:* At the negotiation period, funding competition
167 helps to raise the public sector's information on the deal (Ameyaw and Wilhelm, 2017).
168 However, the cost of gathering this information must not override the savings it brings about.
169 In this instance, the size of the deal, and the number of bidders, has a crucial role in the trade-
170 off (Singh *et al.*, 2006).

171 *Contain private liabilities to small size:* Private liabilities should be contained to an
172 adequately small size (Blanc-Brude, 2013). PPP projects are to be effectively run and should
173 not be extremely leveraged (Danau and Vinella, 2014). *Securing contract enforcement:* To be
174 able to induce the firm to fulfil the contract, there should be the requirement of investing a
175 satisfactorily worthy quantity of money in advance, and it should be allowed to recuperate
176 that investment by the passage of time at the execution stage (Blanc-Brude, 2013).

177 *Contract guarantees and technical assistance:* Modern development banks or current
178 multilateral banks will offer monetary support, assuring guarantees and giving out the most

179 excellent international actions for project evaluation and risk appraisal, and the best
180 techniques of innovative finance (Hart, 2003). All these help reduce MHAS in PPP projects.

181 *Screening:* Screening refers to the term for all activities whereby the principal attempts to
182 gain more accurate information on the quality attributes of the agent which are pertinent
183 (Kumar *et al.*, 2018). These include: references, work probes, certificates, and credit
184 worthiness (Dewatripont and Legros, 2005). *Monitoring:* Monitoring is essential after a
185 contract has been signed. The intent of monitoring is to make certain that the agent is acting
186 in harmony with the contract (Owusu-Manu *et al.*, 2018b). This in the long term decreases
187 the problems of MHAS in PPP projects (Dewatripont and Legros, 2005).

188 *Signaling:* The market party which has more information, for example the contractor, signals
189 its type to the client who is the least informed market stakeholder, using some signals (Kumar
190 *et al.*, 2018). In case of signaling, the initiative goes out from the better-informed market
191 participants who send out their signals first and who only then get contracts offered by the
192 worse informed market party (Dewatripont and Legros, 2005). *Cooperation among project*
193 *participants:* Trust takes time to develop between the parties, and it is very fragile, but once
194 developed it outshines all the other strategies in terms of project control and risk
195 minimization (Osei-Kyei and Chan, 2017a). Formal planning and control systems create
196 more transparency with regard to the actions of the PPP project participants (Danau and
197 Vinella, 2014).

198 **METHODOLOGY**

199 This study was quantitative in nature and deductive research approach was adopted.
200 Questionnaires were the main research instrument to collect data. The designed instruments
201 were pre-tested and piloted before the main survey. As opined by Oppenheim (2000) and
202 Creswell (2005), pre-testing and piloting surveys are significant in establishing complete

203 consistency in the data collection (Yin, 2009). Using stratified sampling technique, two
204 respondents each from government agencies, consultancies and construction firms involved
205 in PPP projects with insightful expertise and having features of proposed respondents were
206 asked to pre-test the questionnaires. These six respondents were asked to check the research
207 instrument (RI) for ambiguity, clearness and time used to finish answering the questionnaires.
208 They were also to give insights which will improve the preciseness of the questionnaires.
209 Feedbacks received indicated that the questionnaires were very clear to comprehend and were
210 very likely to get pertinent answers in the main survey. Comments from the piloting were
211 used to make a few additions and fine-tuning of the questionnaires for the main survey. The
212 real survey spanned two months and respondents were asked to rank twenty (20) strategies to
213 reduce moral hazard and adverse selection of PPP construction projects. The Likert scale 5-
214 point grading system was used where 1=not significant; 2=moderately significant;
215 3=significant; 4=very significant and 5=extremely significant. Mean values greater than 3.00
216 were significant.

217 The sampling technique for this study with relation to its design, purpose, and realistic
218 inference on this research topic is purposive sampling. The researcher chooses what needs to
219 be identified and undertakes to locate respondents who are willing to release the information
220 by merit of experience or knowledge (Tongco, 2007). In this research, this strategy involved
221 identifying the professionals involved in Public-Private-Partnership (PPP) construction
222 projects. Furthermore, snowball sampling was used in getting the sample size due to the
223 challenges encountered in evaluating the population size. This strategy is a solution to
224 reaching hard-to-reach or concealed populations. It exists on the assumption that a link exists
225 among the original sample and extras in the similar target population (Creswell, 2005). This
226 mixed sampling process was used to obtain a representative sample size of fifty-six (56)
227 government agencies, consultancy firms and construction companies in charge of Public

228 Private Partnership projects. Questionnaires were distributed to five (5) respondents in each
229 of these companies and agencies resulting in a total of two hundred and eighty (280)
230 respondents. Two hundred and ten (210) questionnaires representing seventy five percent
231 (75%) response rate was attained.

232 Mean score ranking was used to rank these strategies while reliability analysis was conducted
233 using Cronbach Alpha coefficient. Kendall's concordance analysis was conducted to measure
234 the agreement of different respondents on their rankings of strategies. Factor analysis using
235 Principal Component Analysis (PCA) grouped the strategies into eight components.

236

237 **DATA ANALYSIS AND DISCUSSION**

238 **Respondents' profile**

239 40 percent of respondents work with government agencies in charge of PPP construction
240 projects. 39 percent of respondents work with consulting firms in charge of PPP construction
241 projects. Finally, 21 percent of respondents work with construction firms in charge of PPP
242 construction projects. This research comprises respondents who are working in various
243 sectors and firms responsible with construction projects and are knowledgeable about the
244 operations of PPP construction ventures. This therefore lends credence to the reliability of the
245 study.

246 Since PPP is quite new in the Ghanaian industry, respondents were not restricted to their
247 experience in PPP projects but were rather asked their years of working experience. 10.5
248 percent have less than 5 years' experience. 28.1 percent have 5-10 years' experience. 74
249 respondents representing 35.2 percent have 11-15 years' experience. 14.3 percent have 16-20
250 years of working experience while the remaining 11.9 percent have above 20 years of
251 experience. In conventional work practice and relying on the practical perception of

252 employment practice in Ghana, having at least six years of working experience qualifies a
253 worker for the position of senior management. In addition, possessing at least ten years of
254 working experience makes a worker suitable for the position of senior management. Inferring
255 from this, it can be deduced that the respondents for this study have adequate working
256 experience in the industry. In summary, their responses for this study are seen to be reliable
257 and valid.

258 10.5 percent of respondents have an HND degree. 47.6 percent have a BSc degree.
259 Furthermore, 40 percent have an MSc degree while the remaining 1.9 percent have a PhD.
260 Considering the practical standpoint of the teaching and training courses offered by various
261 professionals in the Ghanaian industry, it can be seen from this results that the majority have
262 passed through the tertiary level with the minimum being a BSc degree. The implication for
263 this study is that, the respondents have satisfactory background in education and hence have
264 the propensity to better understand and interpret the variables. Their responses are therefore
265 anticipated to be credible and consistent.

266 <Insert Table I here>

267
268 **Reliability Statistics**

269 The internal consistency analysis of the responses received shows a Cronbach's alpha
270 coefficient value of 0.812. Tavakol and Dennick (2011) postulated that a Cronbach's alpha
271 coefficient value between 0.800 and 0.900 is good for a research. This implies that the
272 internal consistency of the response that was received is strong. Table II presents the analysis
273 of the reliability statistics of the responses.

274 <Insert Table II here>

275 **Mean score ranking for strategies to reduce moral hazard and adverse selection of PPP**
276 **construction projects**

277 Table III shows the results for the mean score ranking. Based on the mean scores, two factors
278 had means of above 4 and hence were very significant. The top five strategies are stated
279 below with their standard deviation values. *Monitoring* was ranked 1st with a mean of 4.06
280 and standard deviation of 0.891. *Transfer of risks* was ranked 2nd with a mean of 4.02 and
281 standard deviation of 0.923. *Screening* was ranked 3rd with a mean of 3.93 and standard
282 deviation of 0.813. *Managing of construction risks* was ranked 4th with a mean of 3.90 and
283 standard deviation of 0.868. *Increased incentives to control costs* was ranked 5th with a mean
284 of 3.87 and standard deviation of 0.745. All the mean values for the factors in the table were
285 above the population mean (3.0). It is inferred that all these factors are significant as far
286 strategies to reduce moral hazard and adverse selection of PPP construction projects is
287 concerned.

288 In a study conducted in France by Bureau and Mougeot (2007), *benchmarking* was ranked as
289 the most significant factor in reducing MHAS. However in this study, it ranked at a low
290 position of 18th. *Increased incentives to control costs* was identified in a stud by Blanc-Brude
291 (2013) as the most significant indicator for addressing MHAS. In this study, this factor
292 ranked 5th which was also significant and therefore agrees with the past study undertaken.

293 <Insert Table III here>

294 **Kendall's concordance analysis**

295 Kendall's concordance analysis was conducted to measure the agreement of different
296 respondents on their rankings of strategies based on mean values within a particular group. If
297 the Kendall's coefficient of concordance (W) was statistically significant at a pre-defined
298 significance level, a reasonable degree of consensus amongst the respondents indicated.
299 Table IV shows the test results of the Kendall's concordance analysis for each group of
300 stakeholders at a significance test value of 0.05. The values of W range from 0 to +1, where a
301 value further from 0 indicates a strong degree of consistency on the rankings of factors within

302 each group (Sheskin, 2011). Results suggest that there is consistency on the rankings within
303 each group: (government agency, consulting firm and construction firm).

304 <Insert Table IV here>

305
306 **FACTOR ANALYSIS FOR STRATEGIES TO REDUCE MORAL HAZARD AND**
307 **ADVERSE SELECTION OF PPP CONSTRUCTION PROJECTS**

308 **Initial Considerations**

309 With reference to the data presented in Table V, the data from the survey is adequate by these
310 tests. The data has 210 observations per variable with the value of KMO being 0.784 which is
311 greater than 0.50.

312 From Table V, Bartlett's test is highly significant and hence recommended for factor
313 analysis. This determinant of the matrix is used in testing for multicollinearity. The
314 determinant or the R-matrix should be greater than 0.00001. Field (2005) opines that if it is
315 less than the value, the variables that correlate very highly should not be included in the
316 analysis. However, no two variables correlate very highly. Mild collinearity according to
317 Field (2005) is not a problem for factor analysis and hence the data is appropriate for factor
318 analysis.

319 <Insert Table V here>

320 The Guttman-Kaiser rule and the Cattell scree test were used in determining the number of
321 factors to be extracted. Guttman-Kaiser rule suggests that only factors with an eigen value
322 greater than 1 should be retained whilst the Cattell scree test suggests that all further
323 components after the one starting the elbow should not be included. Applying these criteria
324 on the number of principal components to be extracted suggests that **eight (8)** components
325 should be extracted.

326 <Insert Table VI here>

327 **DISCUSSION OF FACTOR ANALYSIS**

328 **Component 1 (Transparent process and contract)**

329 Component one consists of the factors: *Well-designed contract*, *Create a clear and*
330 *transparent process* and *Harmonization of interests*. From observations of the relationship
331 among the variables loaded onto this component, it has been termed ‘Transparent process and
332 contract’ factors. This extracted component accounted for 12.117% of the total variance. It is
333 predictable that these have been weighed highly because the respondents must have
334 considered these strategies as very critical in reducing the problems of moral hazard and
335 adverse selection.

336 *Well-designed contract* with eigen value of 0.896 is very important. Contract is the most vital
337 instrument that regulates the information between the project owner and contractor (Ameyaw
338 and Wilhelm, 2017). Therefore, a well-designed contract which defines the ways of
339 information transfer is the most effective way to decrease the information asymmetry risk
340 (Lobner, 2009). This agrees with past study conducted by (Owusu-Manu *et al.*, 2018b) where
341 well-designed contract was identified as a significant factor in curbing moral hazard and
342 adverse selection in PPP projects.

343 *Create a clear and transparent process* had an eigen value of 0.458. Routinization and
344 standardization will create a market for PPPs that provides the public and private sector with
345 a clear roadmap for success. This will ultimately lead to a reduction of the agency problems
346 of moral hazard and adverse selection (Ameyaw and Wilhelm, 2017).

347 *Harmonization of interests* with eigen value of 0.896 is also another significant strategy. A
348 main instrument for reducing the risks of moral hazard is the harmonization of interests, by
349 profit sharing of the contractor. For the planning participants, contractual incentives must be
350 given so that the targets of the principal are achieved (Dewatripont and Legros, 2005).

351 **Component 2 (Incentives and monitoring)**

352 Component two consists of the factors: *Increased incentives to control costs* and *Monitoring*.
353 It has been named 'incentives and monitoring' factors. This extracted component accounted
354 for 8.743% of the total variance.

355 *Increased incentives to control costs* had an eigen value of 0.599. The self-selection of the
356 most qualified construction companies merged with the incentive to manage costs as a
357 remaining claimant curtails with moral hazard and adverse selection (Blanc-Brude, 2013).

358 *Monitoring* had an eigen value of 0.676. Monitoring is essential after a contract has been
359 signed. The intent of monitoring is to make certain that the agent is acting in harmony with
360 the contract. This in the long term decreases the problems of information asymmetry
361 (Dewatripont and Legros, 2005).

362 **Component 3 (Screening and technical assistance)**

363 The factors of the third component were *Contract guarantees and technical assistance* and
364 *Screening*. This extracted component accounted for 8.185% of the total variance. It was
365 named 'screening and technical assistance' factors.

366 *Contract guarantees and technical assistance* had eigen value of 0.503. Overall, the
367 responsibility of a modern development banks or current multilateral banks would involve
368 steps at national and international stages, comprising from fiscal and risk mitigation features,
369 including the terms of technical guidance (Blanc-Brude, 2013).

370 *Screening* had eigen value of 0.637 and refers to the term for all activities whereby the
371 principal attempts to gain more accurate information on the quality attributes of the agent
372 which are pertinent. These include: references, work probes, certificates, and credit
373 worthiness (Dewatripont and Legros, 2005). The aim of screening is to gain useful

374 information to the principal in an attempt to be more conversant with the qualifications of the
375 agent (Blanc-Brude, 2013).

376 **Component 4 (Unbundling and benchmarking)**

377 Component four consists of the factors: *Benchmarking* and *Financial unbundling*. This
378 extracted component accounted for 7.604% of the total variance. It was named ‘unbundling
379 and benchmarking’ factors.

380 *Benchmarking* had eigen value of 0.754. Asymmetries of information on the operating costs
381 are reduced through benchmarking and market testing processes (yardstick competition).
382 Elementary parts of the service provided by the contractor must be periodically evaluated
383 against market prices (Bureau and Mougeot, 2007).

384 *Financial unbundling* had eigen value of 0.575. Financial unbundling is an effective way of
385 ensuring transparency in projects by inducing a disclosure of the contract financial main
386 points (Kumar *et al.*, 2018).

387 **Component 5 (Funding and small liabilities)**

388 The factors of the fifth component were *Funding competition* and *Contain private liabilities*
389 *to small size*. This extracted component accounted for 7.388 % of the total variance. It was
390 named ‘funding and small liabilities’ factors.

391 *Funding competition* had eigen value of 0.720. At the negotiation period, funding
392 competition helps to raise the public sector's information on the deal. However, the cost of
393 gathering this information should not override the savings it brings about. In this instance, the
394 size of the deal, and the number of bidders, has a crucial role in the trade-off (Singh *et al.*,
395 2006). This agrees with study conducted by Akintayo (2018) on minimizing risks in PPP
396 construction projects.

397 *Contain private liabilities to small size* had eigen value of 0.716. Private liabilities should be
398 contained to an adequately small size (Blanc-Brude, 2013). As well as requiring that the firm
399 not spend so much in the project, in spite of its assets, this necessitates that the firm not
400 depend on debt greatly, even if it has unrestricted access to the credit market. PPP projects
401 are to be effectively run and should not be extremely leveraged (Danau and Vinella, 2014).

402

403 **Component 6 (Information clarification and signaling)**

404 Component six consists of the factors: *Signaling* and *Clarifying the need for information in*
405 *the project*. It has been named ‘Information clarification and signaling’ factors. This extracted
406 component accounted for 7.263% of the total variance.

407 *Signaling* had eigen value of 0.464. The market party which has more information, e.g. the
408 contractor, signals its type to the client who is the least informed market stakeholder, using
409 some signals. In case of signaling, the initiative goes out from the better informed market
410 participants who send out their signals first and who only then get contracts offered by the
411 worse informed market party (Dewatripont and Legros, 2005).

412 *Clarifying the need for information in the project* had eigen value of 0.722. This agrees with a
413 study conducted by Ameyaw and Wilhelm (2017) where need for information was identified
414 as a risk mitigation strategy. The necessity for information which a project participant
415 requires to accomplish his tasks within a definite period of time is explained according to
416 quality, type and quantity (Ameyaw and Wilhelm, 2017).

417 **Component 7 (Risk and contract management)**

418 Component seven consists of the factors: *Managing of construction risks* and *Securing*
419 *contract enforcement*. It has been named ‘Risk and contract management’ factors. This
420 extracted component accounted for 7.211% of the total variance.

421 *Managing of construction risks* had eigen value of 0.721. In financing of projects, not
422 excluding Public-Private-Partnerships, construction risks are controlled by way of a network
423 of contracts (Blanc-Brude, 2008) and transferred to construction companies which efficiently
424 make available insurance against unanticipated construction costs to the financiers and
425 sponsors of the Special Purpose Entity (SPE).

426 *Securing contract enforcement* had eigen value of 0.681. To be able to induce the firm to
427 fulfill the contract, there should be the requirement of investing a satisfactorily worthy
428 quantity of money in advance, and it should be allowed to recuperate that investment by the
429 passage of time at the execution stage (Blanc-Brude, 2013). To be brought on to partake in
430 the partnerships, private firms should be wealthy to start with. This would discourage the
431 speculative and probable unpredictable investors (Danau and Vinella, 2014).

432 **Component 8 (Cooperation and finance)**

433 The eighth and last component had the following factors: *Bond spread*; *External finance*;
434 *Cooperation among project participants* and *Information disclosure*. It has been named
435 'Cooperation and finance' factors. This extracted component accounted for 6.917% of the
436 total variance.

437 *Bond spread* had eigen value of 0.583. An inadequate risk transfer to the contractor is
438 discovered by the reasonability of the bond spread. For instance, if the public partner takes on
439 almost all the demand risk, it is expressed in financial expressions, like providing to the
440 contractor an advance contract for free (Välilä, 2005).

441 *External finance* had eigen value of 0.600. Dewatripont and Legros (2005) distinguish two
442 types of external financiers, outside shareholders and debt creditors. They consider that the
443 financial structure of the contract is not without significance on the private partner incentives.
444 Commercial finance literature reiterates that outside debt or equity might lower incentives to
445 exert effort for the contractor (Jensen and Meckling, 1976).

446 *Cooperation among project participants* had eigen value of 0.755. In connection with moral
447 hazard, the frequency of the cooperation of the project participants is of major importance
448 (Owusu-Manu *et al.*, 2018a). If the contractual partners repeatedly cooperate with one
449 another, this leads to a reduction of information asymmetries. The mutual trust resulting from
450 long-term cooperation will cause a reduction of risk costs (Lobner, 2009).

451 *Information disclosure* had eigen value of 0.552. The agent delivers information to the client
452 using some special files for client's reference. The client will esteem the agent's reputation as
453 a significant evaluation index when he selects agent, which is because the project
454 implementation needs the agent's strength, experience, credibility, moral qualities among
455 others, and these all constitute private information of the agent (Gatti, 2013).

456

457 **CONCLUSIONS**

458 **Summary of findings**

459 From the mean score ranking, Monitoring; Transfer of risks; Screening; Managing of
460 construction risks; and Increased incentives to control costs were the most significant
461 strategies to reduce the problems of moral hazard and adverse selection in PPP construction
462 projects.

463 After the factor analysis using Principal Component Analysis, the eight components were:
464 Transparent process and contract; Incentives and monitoring; Screening and technical
465 assistance; Unbundling and benchmarking; Funding and small liabilities; Information
466 clarification and signalling; Risk and contract management; and Cooperation and finance
467 factors.

468 Empirically, the robust and rigorous identification of MHAS strategies in the current study
469 have useful theoretical, practical and wider implications. Overall, the study makes a unique

470 contribution to the MHAS and PPP body of knowledge through benchmarking the most
471 significant strategies that can be used to reduce PPP project failures arising from MHAS.

472 Theoretically, the research constitutes the first exclusive assessment of the generic,
473 significant strategies in Ghanaian PPP projects. From a theoretical lens, the output of the
474 research contributes to the checklist of strategies that reduce PPP project failures arising from
475 MHAS and may contribute to the development of the agency theory. Additionally, the
476 outcome of the research provides a sound basis for future research on MHAS in PPP projects
477 in any country. This is of relevance to academic, industry and PPP policy researchers.

478 Practically, the identified and prioritized strategies will serve as a guide and managerial
479 support in future PPP projects. Although no case studies were used to validate the findings,
480 the outcome draws on wealth of experiences and lessons and thus, may reflect the realities of
481 PPP project failures. As such, the findings of the research may guide construction
482 stakeholders in reducing failure of PPP projects due to MHAS. These stakeholders and
483 practitioners may improve project success by recognizing and planning against failure of
484 these PPP projects.

485 A limitation in this study is the fact that the research applies mainly to the Ghanaian and
486 makes the generalisation limited to the study environment due to the peculiar nature of PPP
487 projects in different jurisdictions.

488 Since the current findings have not been validated, future studies should adopt interviews and
489 desk reviews to help in triangulation and validation of the strategies of MHAS. This will also
490 expand the relevance of the findings to other national and industry settings.

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