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The grand challenge:
Effective anti-corruption measures in projects

Abstract

A grand challenge in projects involves employing anti-corruption measures effectively for dealing with corruption. Existing research is scattered across a wide range of disciplines and thus understanding of the effectiveness of anti-corruption measures in projects remains obscure. Focusing on construction projects, which are the most studied and affected by corruption, we aim to establish what kinds of anti-corruption measures are effective, and how. We use design-oriented research synthesis to systematically study existing empirical evidence related to anti-corruption measures in construction projects, found in management journals across various disciplines. Our study shows that there is scarce empirical evidence documenting the effectiveness of anti-corruption measures in projects. Nevertheless, our findings show that compliance, managerial, probing, reactive, and regulatory measures can be effective. The two main mechanisms explaining how the different anti-corruption measures are effective are enhanced transparency of project operations and incentivised stakeholders. We conclude with a research agenda focused on project governance.

1. Introduction

Corruption, i.e., the abuse of entrusted power for private gain (Trasparency International, 2021), is one of the major barriers to successfully planning and delivering projects (Treisman, 2007; Tabish and Jha, 2011; Loosemore and Lim, 2015; Locatelli *et al.*, 2017). Corruption increases costs, creates delays, decreases benefits, and limits projects' positive social and economic impacts (Sonuga, Aliboh and Oloke, 2002; Loosemore and Lim, 2015; Damoah *et al.*, 2018). Locatelli et al. (2017) submit that corruption includes, among others, bribery, extortion, fraud, abuse of power, embezzlement, conflict of interest, and nepotism.

To prevent corruption from taking place or mitigate the aforementioned negative consequences, practitioners and academics are paying increasing attention to anti-corruption, i.e., measures to substantially reduce corruption in all its forms (Owusu *et al.*, 2019). Building on (Tabish and Jha, 2012), when we use the word "measures", we include "leadership, rules and regulations, training and fear of punishment" (p. 23) but also policies, managerial approaches, arrangements, measures, practices, etc., derived by individual groups of organisations to reduce corruption.

Despite the relevance of anti-corruption measures, there is a paucity of research on anti-corruption measures, particularly their effectiveness in projects. To establish an initial understanding of anti-corruption measures for our research, we searched and analysed articles in project management journals from Scopus on January 31, 2020 (search and analysis updated on March 11, 2022). The project management journals included the *International Journal of Project Management, International Journal of Project Organization and Management, International Journal of Managing Projects in Business,* and *Project Management Journal*. The research question that guided this research was: *What kinds of anti-corruption measures are effective in projects, and how?*

We found only ten articles with the words *"corruption" OR "anti-corruption"* in either the article title, abstract, or keywords (see Appendix A1 for a summary of the analysis). Five of these articles (Osei-Tutu, Badu and Owusu-Manu, 2010; Bowen, Edwards and Cattell, 2015; Locatelli *et al.*,

45 2017; Damoah *et al.*, 2018) deal with construction projects and focus on corruption rather than anti-

46 corruption. These articles examine the root causes of corruption, how corruption occurs, how

47 corruption impacts projects, and how different project actors perceive corruption. Five other articles

48 (Sonuga, Aliboh and Oloke, 2002; Ling *et al.*, 2014; Walker and Lloyd-Walker, 2014; Damoah and Kumi,

49 2018; Wang *et al.*, 2019) focus on other phenomena such as ethical dilemmas of project management

50 and project failure factors, again, not on anti-corruption measures. The remaining article (Owusu *et*

51 *al.*, 2019) focuses on anti-corruption in projects and is the first and only paper in project management

52 journals focused explicitly on anti-corruption measures.

53   While the existing research on anti-corruption measures and their effectiveness is limited in

54 project management journals (as indicated above), it is obvious that there may be relevant research

55 outside project management journals. However, to our best knowledge, the research on anti-

56 corruption measures in these journals have not been accompanied by integration efforts, which might

57 have resulted in a few small and largely isolated pockets of research across several journals and

58 scientific communities that extend beyond project management discipline. Given the relevance of

59 anti-corruption in projects, a systematic analysis of this growing body of knowledge is missing and

60 needed. Therefore, this study aims to develop a systematic understanding of anti-corruption

61 measures and their effectiveness in projects. We achieved this aim by mapping the existing empirical

62 evidence extending beyond project management journals, using design-oriented research synthesis

63 as our research approach.

64   Corruption is widespread across businesses, and projects are no exception, particularly

65 construction projects. Therefore, in this research, we focus on projects within the construction sector

66 for five reasons: (i) the construction sector is one of the industries most prone to corruption (Treisman,

67 2007; Tabish and Jha, 2011; Transparency International, 2012; Locatelli *et al.*, 2017; Investopedia,

68 2020); (ii) construction is a project-based sector and one of the most studied in project management;

69 (iii) pragmatically, there are likely enough data to perform the analysis; (iv) focusing on one sector

70 only is ideal for obtaining consistent results; (v) developing a more systematic understanding of anti-

71   corruption measures and their effectiveness in construction projects can, in addition to theoretical

72   implications, have widespread beneficial managerial implications.

73   The rest of the paper is organised as follows. Section 2 introduces our design-oriented

74   research synthesis approach, including the article search and review process and analysis protocol.

75   Section 3 presents the findings regarding anti-corruption measures, and Section 4 discusses the

76   findings. Section 5 outlines this paper's managerial implications and theoretical contribution and

77   concludes with research limitations and future research ideas.

78

79   2.   Research methods and analysis

80   We used design-oriented research synthesis as our research approach (Briner and Deyner, 2012).

81   Design-oriented research synthesis is appropriate when empirical evidence of the study phenomenon

82   is scattered across a broad range of publication outlets within different disciplines (Denyer, Tranfield

83   and van Aken, 2008), as in this research. Figure 1 summarises the employed design-oriented research
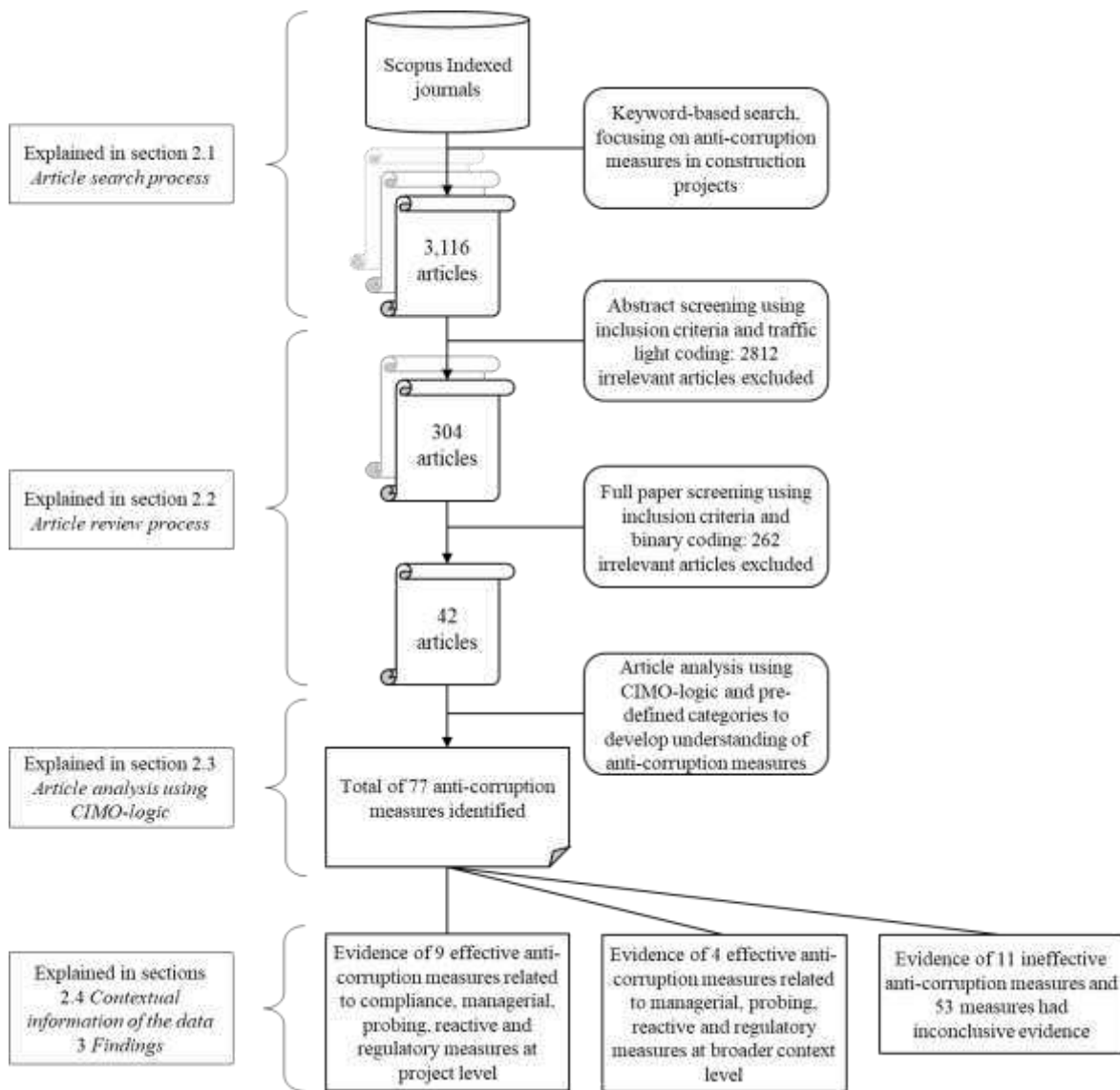
84   synthesis.

```
                                    Scopus Indexed
                                       journals

                                                        Keyword-based search,
Explained in section 2.1                                focusing on anti-corruption
Article search process                                  measures in construction
                                                        projects

                                       3,116
                                      articles

                                                        Abstract screening using
                                                        inclusion criteria and traffic
                                                        light coding: 2812
                                                        irrelevant articles excluded

                                        304
                                      articles

Explained in section 2.2                                Full paper screening using
Article review process                                  inclusion criteria and
                                                        binary coding: 262
                                                        irrelevant articles excluded

                                        42
                                      articles

                                                        Article analysis using
                                                        CIMO-logic and pre-
                                                        defined categories to
                                                        develop understanding of
Explained in section 2.3                                anti-corruption measures
Article analysis using
CIMO-logic                          Total of 77 anti-corruption
                                    measures identified

Explained in sections     Evidence of 9 effective anti-    Evidence of 4 effective anti-   Evidence of 11 ineffective
2.4 Contextual            corruption measures related      corruption measures related     anti-corruption measures and
information of the data   to compliance, managerial,       to managerial, probing,         53 measures had
3 Findings                probing, reactive and            reactive and regulatory         inconclusive evidence
                          regulatory measures at           measures at broader context
                          project level                    level
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Figure 1. Article search, review, and analysis process.

2.1 Article search process

We targeted our search to Scopus indexed journals to ensure sufficiently thorough coverage of

relevant data. We used a keyword-based search protocol to capture data across disciplines. We

devised keywords related to anti-corruption and construction projects directly related to our study

phenomenon, as suggested by (Snyder, 2019) when integrating interdisciplinary empirical findings.

The following keyword-based search was conducted on 18/11/2020, resulting in our initial

sample of 3,116 articles: *(TITLE-ABS-KEY(Corrupt* OR Anticorrupt* OR Anti-corrupt* OR Brib* OR*

95   *Extort* OR Fraud* OR Embezzl* OR "Abuse of power" OR "Conflict of interest" OR Nepotism OR*

96   *Favoritism OR Favouritism OR Illegal*) AND TITLE-ABS-KEY(Project)) AND (LIMIT-TO (DOCTYPE, "ar"))*

97   *AND (LIMIT-TO (LANGUAGE, "English")).* We developed our list of keywords for anti-corruption

98   measures because there is no comprehensive list of words readily available. We relied on the words

99   *corrupt**, *anti-corrupt**, and *anticorrupt** to capture articles discussing anti-corruption directly. We

100 also used the established concepts describing the forms of corruption, bribery, extortion, fraud,

101 embezzlement, nepotism, favouritism, conflict of interest, and abuse of power (see, e.g., (GIACC,

102 2014; Locatelli *et al.*, 2017)) for searching evidence related to anti-corruption measures dealing with

103 specific forms of corruption. We combined the above list of words (separated with the *OR* operator)

104 with the search word *project** (using the *AND* operator) to capture relevant articles. An initial search

105 indicated that labels for construction projects vary hugely (e.g., infrastructure project, a project for a

106 new stadium, district development project, etc.), so including an exhaustive list for all variations

107 proved unfeasible. However, papers with a construction project very commonly include the word

108 "project(s)", so we used this to identify and manually screen papers that focus on construction

109 projects. Using several search terms increased the number of articles and reduced the percentage of

110 relevant ones, but we wanted to be confident that we were not omitting relevant research from the

111 search. We limited the results by setting the language to "English" and document type to "articles".

112 We focused on journal articles to capture peer-reviewed research.

113 2.2 Article review process

114 Consistent with design-oriented research synthesis guidance (Tranfield, Denyer and Smart, 2003;

115 Briner and Deyner, 2012), the article review process included two main phases: an abstract and a full

116 paper review. We randomly assigned the initial sample of 3,116 articles among four authors (779

117 articles for each) for abstract review. Each author read their allocated articles' titles, abstracts, and

118 keywords and coded them following the traffic light coding (Tanskanen *et al.*, 2017), meaning '0' for

119 excluded, '1' for included, and '2' for uncertain. If the article's title, abstract, and keywords did not

120 offer sufficient information to make an informed decision about inclusion or exclusion, the article was

121 coded 2 for uncertain, meaning that a full paper review was required. We used the following three

122 jointly-agreed inclusion criteria for the papers:

1. Must focus on the relevant sector, including any construction project or related project organisation/actor embedded or related to the sector.

2. Must describe or analyse anti-corruption measures in the relevant sector.

3. Must include verifiable empirical data or evidence related to anti-corruption measures (either first-hand or secondary analysis via a review).

128 The first author reviewed and integrated all authors' codings for consistency. We included 304 articles

129 (135 coded as '1', 169 coded as '2') for further analysis based on the abstract review. Next, in the full

130 paper review, we randomly assigned the 304 articles among the same four authors. Each author read

131 the full papers reflecting the same inclusion criteria. The papers were coded '1' for included and '0'

132 for excluded, and a brief reason was documented in case of exclusion. The three main reasons for

133 exclusion were: lack of verifiable empirical evidence or data related to anti-corruption measures; not

134 related to construction projects; duplications. The final sample after the full paper review was 42

135 articles. The final list of articles represents the empirical evidence, and it constitutes the data on which

136 the claims in this paper are based.

2.3 Article analysis using CIMO-logic

138 We analysed the final sample of 42 articles using CIMO-logic. CIMO-logic is a qualitative analysis

139 approach, often used in design-oriented research synthesis, that approaches each article as a case and

140 seeks to develop an understanding of how, in particular Contexts (C), management Interventions (I)

141 invoke specific Mechanisms (M) which lead to certain Outcomes (O) (Denyer, Tranfield and van Aken,

142 2008; Jones and Gatrell, 2014). Thus, in our research, CIMO-logic offers a feasible analysis framework

143 to, in the context of construction projects (C), develop an understanding of anti-corruption measures

144 (I) and how (M) they are effective in dealing with corruption (O).

145   The analysis consisted of three phases. In the first phase, a pilot coding round was conducted

146   to finalise the CIMO-logic component definitions (see second column of Table 1) and thus assure a

147   unified understanding of the coding principles and consistency for the analysis. Each author coded

148   two articles independently and then reviewed each other's coding. A meeting was held afterwards to

149   discuss and reach a consensus about the CIMO-logic component definitions before the analysis.

150   In the second phase, we created a codebook based on the component definitions (see third

151   column of Table 1). Each bullet point represents a coding unit, and we analysed the 42 articles

152   following the codebook. Each author independently analysed the same articles they had included from

153   the full paper review, and thereafter the first author reviewed and integrated the analyses. The second

154   phase resulted in 77 anti-corruption measures from the 42 articles.

155

Table 1. The used definitions for CIMO-components and coding structure.

CIMO-logic component	First phase: Definition in the present research	Second phase: Coding units	Third phase: Synthesis
Context (C)	The underlying geographical area, industry type, project setting (e.g., public, private, PPP), project size (i.e., regular or mega) and actor(s) (e.g., individuals, organisations, institutions) involved in an anti-corruption strategy	- Geographical area (country + city) - Project type (e.g., infrastructure, healthcare) - Project setting (e.g., public, private, PPP) - Project size (e.g., small, large, mega) - Key actors related to the measure (e.g., contractor, government actor)	- Geographical area (continent) - Industry: established sector labels - Project size: mega or regular
Intervention (I)	Anti-corruption measure is a trigger (impetus), ultimately having (or intending to have) an anti-corruption impact: An intentional or unintentional management strategy, approach, arrangement, measure or practice dedicated to oppose or inhibit corruption.	- Measure label (unique, e.g., a specific anti-corruption body) - Verbose empirical description of the measure - Level for devising measure (i.e., country, permanent organisation, project organisation, mixed-levels, person) - Level for implementing measure (i.e., country, permanent organisation, project organisation, mixed-levels, person) - Open comment (i.e., for communicating observations among authors)	- Category of anti-corruption measure: probing, managerial, regulatory, compliance, promotional, or reactive measure - Primary level of anti-corruption measure: project or ecology level
Mechanism (M)	The subsequent activities/actions, steps, and events triggered by an anti-corruption measure that explain how the measure produced outcomes	- Verbose explanation of the mechanism	- Two main mechanisms: enhancing transparency and incentivising stakeholders
Outcome (O)	The measure's impact on corruption (e.g., actors' behavioural change and effects on corruption and the project) with evidential information. The outcome also includes examining the motivation behind the measure (i.e., intended outcome of measure), assumed based on or supported by evidence, to understand and analyse the effectiveness	- Intended purpose (e.g., reduce incidences of bribery) - Impact of anti-corruption measure (verbal explanation)	- Anti-corruption measure outcome: effective, ineffective, or effect unknown - Corruption level: minor or major

157

158   In the third phase, the first and second authors synthesised the second phase codings by

159   incorporating the third and fourth authors' ideas (see fourth column of Table 1). Regarding the

160   "context", we synthesised the geographical area according to continent and project type according to

161   the industrial sector with established labels, e.g., oil & gas or infrastructure. We also synthesised

162   project size into two categories, regular and mega. Regarding the "intervention", we relied on the

163   comprehensive conceptual framework developed by Owusu and colleagues (2019), which includes six

164   categories of anti-corruption measures: probing, managerial, regulatory, compliance, promotional,

165   and reactive measures (categories are introduced in Section 3, and more information of the definitions

166   is available in (Owusu *et al.*, 2019)). The framework is specifically developed for categorising various

167   empirical anti-corruption activities, thus being applicable for synthesising our findings. We categorised

168   the identified 77 anti-corruption measures according to these 6 categories. We also synthesised the

169   level of anti-corruption measure into two categories – project and ecology – to better distinguish

170   project level measures, i.e., those anti-corruption measures implemented at the project level that

171   relate to project management issues (thus are manageable at the project level) from ecology level

172   measures, i.e., activities implemented outside the focal boundaries of a project (e.g., measures at the

173   national/regional level such as governmental anti-corruption regulations) that have profound

174   implications on how projects are planned and managed. The key idea is that looking at a project "in

175   isolation" is relevant but narrow. At the very least, a project (temporary organisation) should be

176   thought on the intersection between the business of a project-based company and a client (both

177   permanent organisations) (Winch, 2014). Expanding the perspective, projects can be seen as an

178   element of project business (Artto and Kujala, 2008) or better project ecologies (Söderlund, 2004;

179   Grabher, 2016; Hedborg, Eriksson and Gustavsson, 2020). In particulary we subscribe to the ecology

180   perspective since it is able to describe be environment in which the project is delivered and *"the links*

181   *between projects and actors (e.g., firms), the sociology of projects, in the economics of projects and in*

182   *the links between project participation and company development (p.661)"* (Söderlund, 2004). Also

183   "*Project ecologies are links and interdependencies between projects with multiple organisational*

184   *actors in project-intensive contexts. Important aspects include the personal relations, localities and*

185   *corporate networks, where the focus lies on interdependencies between projects, actors and their*

186   *contexts (P. 394)"* (Hedborg, Eriksson and Gustavsson, 2020). Therefore, anti-corruption measures

187   related to the planning and delivery of projects should also be examined at the ecology level.

188   Regarding the "mechanism", we first interpreted and sought to identify the logic behind each

189   verbose mechanism description of the chronological events/actions/activities that started from an

190 anti-corruption measure and led to an outcome. We summarised the logic behind each mechanism

191 with a short sentence. After that, we iteratively compared the brief sentences for similarities and

192 differences and synthesised two main mechanisms, the first related to enhancing transparency and

193 the second to incentivising stakeholders. Lastly, regarding the "outcome", we synthesised the anti-

194 corruption measures into three categories: effective, ineffective, and effect unknown. We considered

195 an anti-corruption measure effective when it (even partly) achieved the intended outcome related to

196 dealing with corruption. Appendix A2 shows the final data and coding structure with two examples.

2.4   Contextual information of the data

198 Table 2 shows the distribution of the 77 anti-corruption measures identified in 42 articles in 40

199 different journals with all the references. Table 3 offers information on the context of the 77 anti-

200 corruption measures. Most anti-corruption measures have been implemented in Asian (45) and

201 African (16) countries. The previous resonates with earlier research emphasising that corruption is

202 widespread in those areas (Transparency International, 2020), and thus it is likely that there is also

203 empirical research on anti-corruption measures in these countries. Surprisingly, South America and

204 Eastern and Southern Europe are not well presented in the data, even though these areas are often

205 plagued by corruption (Transparency International, 2020). Anti-corruption measures found from

206 countries within Europe covered Western Russia (St. Petersburg) and Italy, but many Eastern

207 European (e.g., the former Soviet Union) and Southern European countries (e.g., former Yugoslavian

208 area) are missing completely, despite the existence of corruption in these regions (Transparency

209 International, 2022). The anti-corruption measures have been used especially in public sector

210 construction and infrastructure projects of both regular and mega sizes, which resonates with the

211 extant research arguing that corruption is prevalent, particularly in public sector construction and

212 infrastructure development (Transparency International, 2012; Investopedia, 2020). Most of the 77

213 anti-corruption measures (54) have been implemented at the project level. The remaining measures

214 (23) have been implemented at the ecology level.

Table 2. Distribution of anti-corruption measures across different journals and articles.

Journal	N of ACM†	Article reference*
International Journal of Construction Management	11	(Yap *et al.*, 2020)
Journal of Infrastructure Systems	6	(Owusu, Albert P. C. Chan, *et al.*, 2020)
Cities	6	(Owusu, Albert P.C. Chan, *et al.*, 2020)
Public Money and Management	5	(Deng *et al.*, 2014)
International Journal of Climate Change: Impacts and Responses	3	(Fadairo *et al.*, 2018)
International Forestry Review	3	(Hill, 2000)
Journal of Political Economy	3	(Olken, 2007)
Journal of Professional Issues in Engineering Education and Practice	3	(Damit, 1983)
Development Policy Review	2	(Suhardiman and Mollinga, 2017)
Canadian Journal of Administrative Sciences	2	(Jiménez *et al.*, 2020)
Eurasian Geography and Economics	2	(Trumbull, 2010)
Crime, Law and Social Change	2	(Anechiarico and Jacobs, 1994) (Marquette and Doig, 2004)
International Journal of Project Management	2	(Locatelli *et al.*, 2017) (Sichombo *et al.*, 2009)
Culture, Theory and Critique	1	(Goldstein, 2018)
Journal of Public Procurement	1	(Tanaka and Hayashi, 2016)
Information Technology and People	1	(Johri and Nair, 2011)
Foresight	1	(Abdul Rahim, Mohd Amin and Mohd Razali, 2020)
Journal of Social Studies Education Research	1	(Pujiyono, Setiawan and Hutabarat, 2019)
Journal of Theoretical and Applied Information Technology	1	(Zakaria *et al.*, 2014)
Journal of Management in Engineering	1	(Hosseini *et al.*, 2018)
Journal of Urban Economics	1	(Cai, Wang and Zhang, 2017)
Eurasia Journal of Mathematics, Science and Technology Education	1	(He, Yang and Gao, 2017)
Political and Legal Anthropology Review	1	(Yessenova, 2012)
Journal of Siberian Federal University - Humanities and Social Sciences	1	(Damm *et al.*, 2019)
Construction Economics and Building	1	(Aduwo *et al.*, 2020)
Journal of South Asian Development	1	(Sabet and Tazreen, 2015)
World Affairs	1	(Werlin, 2005)
Asian Politics and Policy	1	(Mendoza and Cruz, 2020)
Leadership and Management in Engineering	1	(Hartley, 2009)
Proceedings of the Institution of Civil Engineers: Forensic Engineering	1	(Signor *et al.*, 2017)
Proceedings of Institution of Civil Engineers: Management, Procurement and Law	1	(Yakubu, 2019)
Public Works Management and Policy	1	(Haynes, 1999)
Theoretical and Empirical Research in Urban Management	1	(Ebekozien, 2019)
International Journal on Advanced Science, Engineering and Information Technology	1	(Hesna *et al.*, 2019)
Research and Politics	1	(Buntaine and Daniels, 2020)
International Studies Quarterly	1	(Winters, 2014)
Water Alternatives	1	(Venot, Andreini and Pinkstaff, 2011)
Journal of Construction Engineering and Management	1	(Mahpour and Mortaheb, 2018)
Asian Journal of Political Science	1	(Mahalingam, 2006)
Journal of Financial Crime	1	(Sofe, 2020)
Total of 40 journals	Total 77	

*Full reference details included in the reference list

†ACM = anti-corruption measures

Table 3. Contextual information of the 77 anti-corruption measures.

Geographical area							
Continent	Asia	Africa	North America	Multi-context	South America	Europe	Oceania
N of ACM*	45	16	5	4	3	3	1

Project setting					
Project setting	Public	Mixture	Private	NGO	PPP
N of ACM*	33	31	8	4	1

Industry type									
Industry type of ACM*	General construction	Infrastructure	Forest	Oil & Gas	Residential	Agricultural	Energy	Irrigation	Real estate
	41	22	6	2	2	1	1	1	1

Project size			
Project size N of ACM*	Both 44	Regular 23	Mega 10

Intervention level		
Intervention level N of ACM*	Project 54	Ecologyt 23

*ACM = anti-corruption measures

3. Findings

To summarise our findings, Table 4 categorises the 77 anti-corruption measures into six distinct

measure categories. We have further classified the anti-corruption measures into either the project

or ecology level, which also indicates the level of effectiveness in dealing with corruption in

construction projects. Throughout the remainder of this section, we outline the measure categories

and explore the studies that highlight where corruption (in construction projects) was effectively

planned/managed.

Table 4. Categories of anti-corruption measures with information on their effectiveness.

	Project level				Ecology level				Total
	N of anti-corruption measures with:				N of anti-corruption measures with:				
Anti-corruption measure category	Effective outcome	Ineffective outcome	Unknown outcome	Subtotal	Effective outcome	Ineffective outcome	Unknown outcome	Subtotal	
Compliance measures	1	-	4	5	-	-	1	1	6
Managerial measures	1	3	9	13	2	1	4	7	20
Probing measures	4	2	7	13	1	1	3	5	18
Promotional measures	-	1	7	8	-	-	2	2	10
Reactive measures	1	1	4	6	1	-	-	1	7
Regulatory measures	1	2	6	9	1	-	6	7	16
Total	8	9	37	54	5	2	16	23	77

3.1 Compliance measures

Compliance measures relate to anti-corruption activities that ensure adherence to stipulated anti-corruption norms, regulations, demands, requests, and principles (Owusu *et al.*, 2019).

We found one anti-corruption measure related to contractual compliance that effectively dealt with corruption in construction projects, as shown in (Mahpour and Mortaheb, 2018). Mahpour and Mortaheb examine the role of a financial-based incentive plan (anti-corruption measure) to reduce illegal dumping in the residential building industry of Iran. They designed a financial-based incentive plan based on guidelines elicited from survey respondents' comments, content analysis, and plugging gaps of previous known incentive-based plans. The plan incentivises stakeholders to change their behaviour and save money by reducing purchased materials, wasted materials, landfills, and illegally dumped waste. The savings are then shared in an 'alliance-type' situation among the stakeholders. Mahpour and Mortaheb then conducted a quasi-experiment, where the plan was implemented in a construction project and compared to a situation in the same project without the incentive plan. The outcome of said experiment showed that the financial-based incentive plan reduced the costs associated with illegal dumping by 50%. Thus, this study makes a strong case for the importance of contractual incentives, demonstrating their ability to help mitigate the abuse of entrusted power for private gain in construction projects.

3.2 Managerial measures

Managerial measures relate to proactive administrative activities that are often project- and organisation-specific, and are intended to effectively administrate the internal structures and related organisations against corruption (Owusu *et al.*, 2019).

We identified three anti-corruption measures related to administrative activities that effectively dealt with corruption in construction projects. By way of example, (Haynes, 1999)

257   investigated how three administrations (Inspector General, State auditor, and Attorney general) in

258   Boston, USA established an independent project oversight coordination commission (anti-corruption

259   measure) to manage waste, fraud, and abuse of public funds in the Boston Central Artery/Tunnel

260   (CA/T) Project. All three administrations in this committee had individual responsibilities to oversee

261   the project and support its management, making all project operations more transparent to the public.

262   The Inspector General pursued statutory mandates, reviewed budget and finance plans, reviewed and

263   approved building construction, monitored contracts, investigated criminal/civil violations, and

264   frequently published case studies about the project. The State auditor monitored change orders,

265   audited, provided technical assistance on finance/accounting systems, reviewed oversight,

266   construction, and design of contracts, and published audit reports. The Attorney General enforced

267   civil/criminal laws, cut costs through alternative dispute resolution, reviewed legality of bidding

268   processes, and trained project managers on cost avoidance measures.

269   In addition to individual duties, the three administrations shared some responsibilities,

270   including joint investigations, launching competitive bidding initiatives, and mediation and dispute

271   resolution. The committee successfully dealt with corruption in the case project: "*stellar performance*

272   *by the individual commission members in any traditional sense—such as corruption uncovered,*

273   *mismanagement revealed, wasteful practices identified, and criminal cases prosecuted*" ((Haynes,

274   1999), p. 237). Although the evidence demonstrates that the committee had successfully detected

275   and extirpated corruption, Haynes emphasised that a proactive anti-corruption approach may be

276   more effective in the long term.

277   **3.3 Probing measures**

278   Probing measures relate to proactive anti-corruption activities that have the purpose of facilitating a

279   functioning reporting and recoding system and an effective investigation and/or auditing process in

280   the a construction project (Owusu *et al.*, 2019).

281   We found five anti-corruption measures related to probing measures that effectively dealt

282   with corruption in construction projects. One anti-corruption measure concerns whistleblowing, as (Olken,

283   2007) discusses. Olken designed an anonymous form for whistleblowing (anti-corruption measure)

284   through which community members could anonymously report corruption and corrupt practices in

285   Indonesian village road projects. They then distributed said form to villages where new roads were

286   developed, allowing the villagers to report corrupted practices about the projects without fear of

287   retaliation. The forms were collected in sealed drop boxes dedicated to whistleblowing, and the

288   results were summarised at periodical village meetings. The form was incredibly effective, serving two

289   main functions. First, it was a deterrent as it incentivised those in charge of project decisions (e.g.,

290   village government and village elites) to not engage in corruption (and embezzlement of funds

291   specifically) because they would likely get caught. Second, the anonymous form made project

292   operations more transparent, as villagers could report their perspectives on what was going on in the

293   projects at the grassroots level. Summarising the findings, Olken (2007, p. 204) notes that "*form*

294   *treatment did reduce missing expenditures [indicator for embezzlement]…, but only when the*

295   *comment forms were distributed entirely via village schools, completely bypassing the village*

296   *government and preventing village elites from disproportionately channelling the forms to their*

297   *supporters*". This evidence suggests that anonymous and unbiased (i.e., not controlled by a third party

298   with a conflict of interest) channels for whistleblowing can effectively reduce the incidence of

299   embezzlement.

300   In the same article, (Olken, 2007) also designed an audit treatment in Indonesian village road

301   projects where certain villages were told beforehand that the central government audit agency would

302   audit their construction project. Projects with this treatment were compared to similar village road

303   projects that had no treatment (which acted as the control group). Olken found that, in construction

304   projects subject to government audits compared to projects with no auditing treatment, missing

305   expenditures (indicator for embezzlement) were reduced by eight percentage points. This effect was

306   measure by quantifying discrepancies between official project costs and independent engineers'

307   estimates of costs. In sum, the study suggests that auditing (or at least fear of auditing and public

308   transparency of project activities) can play a pivotal role in reducing corruption (specifically

309   embezzlement in this case), even in highly corrupt environments.

310   Another finding relates to supervision, contract monitoring, and auditing simultaneously,

311   shown in (Zakaria *et al.*, 2014). In their study, they examined the role of a new e-tendering and e-

312   procurement system in Malaysian public construction projects. In 2000, the Federal Government of

313   Malaysia adopted an e-tendering system, a virtual trading environment based on Internet

314   technologies that enables government agencies to procure construction industry services and

315   products internationally and locally. This new system was intended to improve public sector

316   procurement's overall efficiency and quality and avoid unethical practices. The authors gathered

317   experiences and insights from contractors who had used the system, finding that although the system

318   was not yet flawless and completely corruption free, it could improve the situation and mitigate

319   corruption in the public construction industry. For example, the e-tendering system enhanced

320   transparency in procurement measures as every procurement was carefully monitored and recorded

321   down to every detail through the new system, making corruption more visible. The study therefore

322   demonstrates that this kind of e-tendering/e-procurement system facilitates transparent supervision,

323   monitoring, and auditing, which can reduce the rate of corruption in construction projects.

324   A fourth finding relates to auditing (Anechiarico and Jacobs, 1994). Anechiarico and Jacobs

325   examined the role of auditing (anti-corruption measure) within the public administration of New York

326   City, USA. The New York municipality began continuous and accurate auditing of all of its activities

327   (including construction projects), pursuing corruption-free government during the 20th century. The

328   auditing took place in different forms, and different actors initiated it throughout the century – even

329   some new agencies were established to implement auditing. Auditing was based on a random

330   sampling of public sector activities, and led to meticulous investigations. Investigations were not

331   disclosed until they had reached conclusive results, meaning that public officials could be unaware

332   that they or their construction projects were being audited. Said public officials had to continuously

333   provide detailed and transparent information about their construction projects so that every activity

334   was transparently observable to every detail. The case study shows that this auditing has been a major

335   deterrent for public officials in New York City to not engage in corruption, especially when detailed

336   auditing became more intensive, meticulous, and overall bureaucratic. However, the study also

337   showed that detailed auditing could have its downsides as too much control and bureaucracy can

338   paralyse the officials from doing their work: *"[a]s one former commissioner told us, 'It's more*

339   *important to look honest than to get anything done"* (Anechiarico and Jabocs, 1994, p. 374). Still, the

340   evidence presented suggests that auditing can have a positive effect in dealing with corruption of

341   public sector actors involved in construction projects.

3.4 Promotional measures

343   Promotional measures include activities designed to publicise or propagate other anti-corruption

344   measures and educate construction project organisations and stakeholders about corruption (Owusu

345   et al., 2019).

346   We did not find evidence in our analysis that promotional measures effectively deal with

347   corruption in construction projects. Altogether, we identified ten promotional measures, of which one

348   was found ineffective, and for nine, the effect was unknown (e.g., inconclusive evidence). The analysis

349   does not indicate that promotional measures are ineffective, but this issue needs further research to

350   make sound conclusions.

3.5 Reactive measures

352   Reactive measures relate to anti-corruption activities that seek to punish organisations and individuals

353   found guilty of engaging or committing corruption in construction projects (Owusu *et al.*, 2019).

354   We found two effective reactive measures related to investigations and court proceedings

355   that effectively dealt with corruption in construction projects. For example, (Signor *et al.*, 2017) show

356   how the forensic investigators of the Federal Police in Brazil investigated and uncovered evidence of

357   collusive bidding in Brazilian infrastructure projects that led to disclosing the cartel and shutting it

358   down (anti-corruption measure). The Federal Police observed that a noteworthy part of the national

359   oil company's bids was clearly higher than other bids, being an indicator for analysing the suspected

360   organisation in detail. Their detailed investigation uncovered the following: "*the same set of bidders'*

361   *proposals […] were significantly higher than the estimated market value. Evidence […] indicated a*

362   *consortium had been formed, which comprised the country's largest construction/engineering firms*

363   *that were capable of submitting independent proposals. In addition, the winning bids […] were*

364   *significantly higher than tenders submitted by the same bidders in unfettered bids, either as a*

365   *consortium or individually. Moreover, evidence has revealed that there had been a proclivity for losing*

366   *tenders to have been submitted as 'cover' prices. […] collusion had taken place with the 'oil' company*

367   *and the member construction firms of the League of 16"* (Signor et al., 2017, pp. 115-116). To find

368   further evidence, the Federal Police investigators continued the inquiry by comparing the bid patterns

369   of the suspected 16 actors against those that were not under suspicion for similar projects of the 'oil'

370   company (Signor et al., 2017, p. 117). The case study presents in detail the approach adopted by the

371   Brazilian Federal Police that made the bidding behaviour of suspected firms transparent and yielded

372   statistically significant results of different behaviour between the two groups, offering evidence of the

373   collusion behaviour of the 16 firms. The investigations of the Federal Police led to holding the firms

374   accountable, and the cartel was disclosed and shut down. Many of the involved firms and officials

375   have admitted being guilty, and many have been found guilty, indicating that inquiries and

376   investigations can effectively eliminate corruption in construction projects.

377   **3.6 Regulatory measures**

378   Regulatory measures relate to statutory acts, decrees and laws and institutional regulations that have

379   been established to inhibit corruption in construction projects (Owusu *et al.*, 2019).

380   We found two regulation based anti-corruption measures (i.e., anti-corruption policies) that

381   effectively dealt with corruption in construction projects. For example, (Winters, 2014) studies the

382   effect of the World Bank's policy on precision targeting of funding (anti-corruption measure) on the

383   incidence of capture (misappropriation of funds) in projects in developing countries. The policy

384   ensures that funds are allocated to projects precisely targeted at a particular constituency, e.g., single

385   cities, regions, businesses, industry, or particular social groups. Winters contemplates that the policy

386   leads to greater clarity of responsibility and clearer lines of accountability within the host country's

387   government, facilitating a constituency to detect those responsible for poor performance and lodge

388   complaints about problems. When the lines of responsibility are clear and transparent,

389   misappropriation is less likely to occur as it is easier to hold politicians and officials accountable. Thus,

390   they are more likely to face the consequences of improper project implementation. Also, when a

391   project is implemented in a single area, the local community has better opportunities to monitor and

392   report whether the project and its services and goods have arrived compared to projects at the

393   national level where outputs are more difficult to monitor. Using several estimators and control

394   variables at the project- and country-level, Winters tested the effect of the policy on the incidence of

395   capture quantitatively using World Bank's data on nearly 600 World Bank-funded investment projects

396   (including construction projects). He found that "*the probability of a targeted project experiencing*

397   *capture [misappropriation of funds] is 11.4-percentage points less as compared to a non-targeted*

398   *project*" (Winters, 2014, p. 400), indicating that targeting funding policy can be effective in dealing

399   with corruption.

400

401   ## 4. Discussion

402   Our analysis identified that compliance, managerial, probing, reactive, and regulatory measures

403   relating to anti-corruption can effectively deal with corruption. Conversely, we found no evidence

404   about the effectiveness of promotional measures. We acknowledge that the absence of evidence is

405   evidence of absence, meaning that promotional measures can still, in fact, be effective. It is interesting

406   to contemplate how the anti-corruption measures were effective. We identified two fundamental

407 mechanisms explaining the effectiveness of anti-corruption measures: enhancing transparency and

408 incentivising stakeholders, as summarised in Table 5.

409 *Table 5. The two main mechanisms explaining how anti-corruption measures are effective*

Anti-corruption measure category	Main mechanisms explaining the effectiveness of an anti-corruption measure			
	Enhancing transparency	Incentivising stakeholders	Both	Total
Compliance measures	-	1	-	1
Managerial measures	2	-	1	3
Probing measures	5	-	-	5
Promotional measures	-	-	-	-
Reactive measures	2	-	-	2
Regulatory measures	1	-	1	2
Total	10	1	2	13

410

411 The idea that transparency is critical for anti-corruption is not new in project studies (Sohail and Cavill,

412 2008; Kenny, 2012; Locatelli *et al.*, 2017). However, we went a step forward, identifying ten specific

413 anti-corruption measures that enhance transparency in construction project activities and lead to

414 effective outcomes in dealing with corruption. The findings also showed that individual anti-corruption

415 measures alone seldomly suffice for enhancing transparency. On the contrary, transparency results

416 from multiple coordinated anti-corruption measures implemented both at the project and ecology

417 level, as shown in the data, e.g. (Haynes, 1999). Therefore, a 'holistic' and comprehensive approach

418 to anti-corruption in construction projects needs to engage not only actors at the project level but

419 also at the ecology level. As we know from Locatelli and colleagues' study (2017), the institutional

420 context plays a key role in corruption as they coined the term 'corrupt project context', meaning

421 project environments where corruption is endemic. The previous sections highlights the importance

422 of anti-corruption measures at the ecology level when considering how to deal with corruption within

423 the focal boundaries of a project (e.g., measures at the national/regional level such as governmental

424 anti-corruption regulations). Anti-corruption measures outside the focal boundaries of a project can

425 have profound implications on how the project is planned and managed. Hence, focusing anti-

426 corruption measures only at the project level 'in isolation' is relevant but offers a narrow view that

427 may have severe shortcomings in effectiveness via enhanced transparency. The project ecology

428 perspective (Söderlund, 2004; Grabher, 2016; Hedborg, Eriksson and Gustavsson, 2020) can help us

429   better understand anti-corruption measures and their effectiveness in the intersection between the

430   business of a temporary project organisation and its surrounding permanent environment (Locatelli

431   *et al.*, 2017).

432   When transparency is properly enhanced, i.e., multiple measures targeted at both project and

433   ecology levels, it plays a central function for anti-corruption purposes. It reduces the opportunities of

434   corruption by exposing wrongdoers and increasing their risk of being caught, which might lead to legal

435   consequences (e.g., criminal liability) and reputational damage. Ultimately, transparency is a critical

436   deterrent that increases the accountability of project stakeholders. This deterrent has an effect in the

437   present and future because evidence of corruption can expose the wrongdoers pre-emptively and

438   post hoc. A further reflection concerns the advancement in technology, for instance, artificial

439   intelligence and other technologies (e.g., e-tendering/e-budgeting that was visible in our data as well)

440   that bring new prospects for the potential to process large sources of evidence and documentation,

441   so the ability to identify traces of corruption is likely to increase in the future in a transparent

442   environment.

443   Transparency is more than a mere deterrent. It reduces the opportunity for corruption which

444   is one of the key determinants for white-collar crimes such as fraud (Cressey, 1953). If transactions in

445   projects are to be fully documented and public, some forms of corruption are simply no longer viable.

446   Yet, large construction projects pose a significant challenge for transparency due to their socio-

447   technical complexity (Maylor and Turner, 2017). Even if available and documented, the complexity

448   associated with decisions and contracts (and governance arrangements in general) makes project

449   transactions complicated to understand and obscure, leading to difficulties in enhancing transparency.

450   We further elaborated the role of transparency as a mechanism and developed three components

451   that deal with corruption by enhancing transparency:

452   1. Documentablity: project information (particularly decisions, activities and motivations,

453   underlying processes, and contract information) must be recorded and stored systematically.

454   For example, a critical decision should be reported in a 'Minute of Meeting' saved in an

455   electronic format, rather than a discussion with no recordings.

456   2. Publicity: The existence of well-documented information alone is not sufficient to enhance

457   transparency in construction projects. Confidentiality arrangements can prevent interested

458   people from accessing such information. Therefore, another critical component of

459   transparency is the ability to access recorded information. Openly consultable project

460   documents (e.g., concessions) are more transparent than those hidden from the public.

461   3. Simplicity: The most critical information concerns project decisions, the decision-makers, the

462   process followed for making decisions, and the justification of such decisions. The less

463   complex the documented information associable with the project, the more transparent it is.

464   A project's information can become complex for two main reasons. On the one hand, the

465   decisions and governance arrangement can be inherently complex, so their documental

466   representation is also complex, even if well-documented. On the other hand, simple

467   governance arrangements can be documented in a complex and ambiguous way so that even

468   if the information is documented and public, it is not meaningful. Hence, simplifying the

469   complexity of project governance and associated decisions in documentation is a key

470   component of transparency.

471   The second fundamental mechanism underlying the effectiveness of anti-corruption measures is

472   incentivising stakeholders to not engage in corrupt practices. For instance, (Mahpour and Mortaheb,

473   2018) presented a financial-based incentive plan for the parties to comply with the legal and

474   regulatory requirements. The empirical evidence considered mainly financial incentives, but

475   incentives do not necessarily need to be financial, so we prefer to consider them to be more general

476   and comprehensive, i.e., incentives that align stakeholders' objectives and activities with anti-

477   corruption goals.

478   Incentives can apply to potential wrongdoers and other observers who are not involved in

479   corruption. In the former case, stakeholders refrain from participating in corruption because the

480   incentive provides a valuable alternative, like the financial-based plan (Mahpour and Mortaheb, 2018),

481   and their risk exposure is reduced. In the latter case, observers (e.g., external stakeholders) have an

482   additional motivation to denounce corruption, e.g., due to a form of whistleblowing channel that

483   makes it easy to report corruption or suspicions of corruption. As a result, the risk for wrongdoers to

484   get caught is much higher because any informed person has the incentive to denounce corruption.

485   Incentives can form a powerful mechanism behind the effectiveness of anti-corruption

486   measures. Assuming rational wrongdoers (i.e., actors who try to maximise own gain through corrupt

487   practices), incentives inhibit corruption because the legitimate alternative is more valuable, especially

488   if they are adjusted by the risk of being caught. Effectively, incentives increase the opportunity cost

489   for corruption and provide a low-risk alternative with some advantages, e.g., financial benefits. In

490   principle, incentives can lead to effective outcomes, but they can also be counterproductive. When ill-

491   designed, incentives can distort the market and create the opportunity for fraud (i.e., engaging in

492   corruption covertly and also taking the valuable alternative). That is, if ill-designed incentives are not

493   mutually exclusive with corruption, wrongdoers can potentially combine the benefits derived from

494   both corruption and anti-corruption incentives. With this respect, active assessment and enforcement

495   are critical, so wrongdoers cannot benefit from anti-corruption incentives.

496

497   5.   Conclusions

498   5.1   Theoretical contribution

499   Our analysis of anti-corruption measures and previously published evidence yielded an understanding

500   of 13 effective anti-corruption measures, offering second-hand evidence of how different anti-

501   corruption measures can be effective in dealing with corruption in projects, enhancing our

502   understanding of anti-corruption measures in previous project studies (Osei-Tutu, Badu and Owusu-

503   Manu, 2010; Bowen, Edwards and Cattell, 2015; Locatelli *et al.*, 2017; Damoah *et al.*, 2018). More

504 importantly, our study offers a new understanding of transparency and incentives that are two key

505 mechanisms explaining how anti-corruption measures effectively deal with corruption. This study

506 supports the idea that transparency is a pivotal mechanism for effective anti-corruption measures in

507 construction projects, and we contribute by elaborating the concept of transparency further.

508 Transparency is characterised by three main components (i.e., documentablity, publicity, and

509 simplicity) that need to be considered when devising anti-corruption measures to enhance

510 transparency. In addition, achieving transparency can depend on multiple coordinated anti-corruption

511 measures targeted both at project and ecology levels, highlighting the importance of planning and

512 implementing anti-corruption measures outside the focal boundaries of a project (i.e., ecology level)

513 in collaboration with relevant actors. The mechanism is two-fold since anti-corruption measures can

514 incentivise stakeholders to not engage in corrupt practices and/or align stakeholders' objectives and

515 activities with anti-corruption goals.

5.2 Managerial implications

517 In managing projects, particularly in corrupted contexts, there is the grand challenge of dealing with

518 corruption. Our research findings offer project managers practical guidance on dealing with corruption

519 effectively. Based on our findings, we recommend managers and decision-makers (including project

520 managers) to incorporate multiple anti-corruption measures (related to compliance, managerial,

521 probing, reactive, and regulatory) simultaneously when planning and implementing their anti-

522 corruption strategy. In doing so, managers are advised to consider both project and ecology levels,

523 looking beyond the focal boundaries of their project to broaden the perspective on anti-corruption.

524 In practice, this means that managers and decision-makers need to engage deeply with relevant actors

525 outside the project's typical stakeholder boundaries, for example, by contacting NGOs, local

526 communities' representatives, and governmental organisations/authorities, and by investing

527 resources in developing the anti-corruption measures for a particular project. By doing so, managers

528 and decision-makers can plan relevant measures for tackling corruption both within the project and

529   outside of it (e.g., issues related to endemic corruption and corrupt project context), which is essential

530   for effective anti-corruption.

531   When doing the above, managers should consider the two main mechanisms that essentially

532   yield effective results. First, anti-corruption measures need to enhance the transparency of project

533   activities. For example, regulatory measures can dictate that all project activities must be documented

534   systematically and be accessible publicly, and the information must be simplified for enhanced

535   accessibility. Also, compliance measures can be implemented to ensure that the regulatory measures

536   are followed appropriately. This example highlights the role of transparency in dealing with

537   corruption. Second, anti-corruption measures should incentivise stakeholders not to engage in corrupt

538   practices and/or align stakeholders' objectives and activities with anti-corruption goals. Incentives,

539   e.g., financial alternatives to corruption, can prevent corruption because the legitimate alternative is

540   more valuable. Incentives can also increase the opportunity cost for corruption and provide a low-risk

541   alternative with some advantages, e.g., financial benefits. However, project managers need to be

542   cautious because ill-defined incentives can distort the situation and create perverse opportunities,

543   including fraud. That is, engaging in corruption covertly and taking the valuable alternative as well.

544   Therefore, project managers need to ensure that incentives are mutually exclusive with corruption so

545   that wrongdoers cannot combine the benefits derived from both corruption and alternatives.

546   5.3   Limitations and Future research

547   Our design-oriented research synthesis has two main limitations. First, the analysis of the literature

548   was focused on peer-reviewed publications. While the process of selecting relevant papers was not

549   too stringent, we found few (42) journal articles with strong empirical evidence to demonstrate the

550   effectiveness of anti-corruption measures. Further empirical evidence needs to be gathered to make

551   more definitive conclusions about the effectiveness of various anti-corruption measures. Books, book

552   chapters, conference proceedings, and non-peer-reviewed literature in general (including grey

553   literature such as institutional reports and standards) might include other relevant empirical evidence.

554   The second main limitation of this study is the complexity of the research phenomenon and

555   the utilised analysis approach that made it difficult to derive and analyse the combinations of different

556   anti-corruption measures. Using the CIMO logic, we identified the main types of anti-corruption

557   measures and derived the main mechanisms associated with them, namely enhancing transparency

558   and incentivising stakeholders. Yet, the data also included a few scenarios where multiple anti-

559   corruption measures were utilised concurrently. The employed analysis approach was not feasible to

560   evaluate the combined effects of multiple anti-corruption measures comprehensively and

561   systematically. Also, due to the complexity of the research phenomenon and limited empirical

562   evidence available, it was not possible to distinguish effective measures from ineffective ones in

563   combination scenarios.

564   To our surprise, the research showed that there is limited empirical evidence on the

565   effectiveness of anti-corruption measures in the context of projects. Even though there are many

566   publications on corruption and anti-corruption, very few of them empirically assess the effectiveness

567   of anti-corruption measures. More broadly, reading the wider literature on anti-corruption and

568   analysing our findings is clear that project governance (Ahola *et al.*, 2014) plays a central role in anti-

569   corruption. Existing research has emphasised the relevance of governance for governability (Müller,

570   Pemsel and Shao, 2014), financing (Sainati *et al.*, 2020), and ultimately project performance (Joslin

571   and Müller, 2016). Yet, limited attention has been placed on the role of project governance for anti-

572   corruption. Our research highlights the relevance of project governance for transparency and

573   incentives, which are the two fundamental mechanisms underlying the effectiveness of anti-

574   corruption measures. There is very limited emphasis on transparency in the existing studies about

575   project governance, which can be investigated further in future research.

576   Also, transparency and governance are connected with complexity (Baccarini, 1996), a

577   popular topic in project studies (Brady and Davies, 2014; De Rezende, Blackwell and Pessanha

578   Gonçalves, 2018). Incentives are widely studied in project governance (Meng and Gallagher, 2012;

579   Müller, Pemsel and Shao, 2014). Yet, the typical focus is about aligning stakeholders' objectives among

580   themselves (Müller *et al.*, 2016; Ahola, Ståhle and Martinsuo, 2021), and along with the objectives of

581   the underlying project (Kaiser, El Arbi and Ahlemann, 2015; Müller, Pemsel and Shao, 2015). We

582   suggest considering a further perspective: aligning the stakeholders' objectives with anti-corruption.

583   The evidence assessed by this research suggests that traditional governance frameworks ignore the

584   purpose of anti-corruption. If the objective of multiple stakeholders is too corrupt because it provides

585   value to all parties involved (as is often the case), then the traditional governance approach favours

586   corruption by aligning their interests. Project governance alone provides a set of instruments that can

587   be used for whatever purpose. What matters is the intention of designing, implementing, and

588   operating within the governance framework. This counterintuitive issue can be particularly severe in

589   corrupt contexts, where the stakeholders are more likely to embark on corruption. We advocate for

590   identifying anti-corruption incentives as part of project governance. Even in corrupt contexts, the

591   interest expressed by the legal and ethical principles has tangible incentivising effects for project

592   stakeholders. All this considered, a research agenda grounded on project governance and corruption

593   might include the following research questions:

594   • How is it possible to align stakeholders' interests in project governance with anti-corruption?

595   • What is the relationship between forms of project governance and corruption/anti-corruption?

596   • Why are certain forms of project governance more prone to corruption than others?

597   • How is it possible to enhance transparency in project governance?

598   • What are the incentives for stakeholders involved in the project governance to develop anti-

599   corruption measures?

600   • Which form of project governance is better to deliver projects in a corrupt context?

601   • How is it possible to exclude 'corrupted stakeholders' from the project governance?

602   • Which ethical principles should be used to design project governance resilient to corruption?

603   **Declaration of Competing Interest**

604   The authors declare no conflict of interest.

Appendix A1. Articles published in leading project management journals dealing with corruption in alphabetical order by authors.

Bibliographical information	Aim and context	Design / method	Data	Key findings	Authors' conclusions related to anti-corruption measures in construction projects
(Bowen, Edwards and Cattell, 2015) International Journal of Project Organisation and Management	Analysis of the experiences and opinions of clients and construction professionals regarding corruption in the South African construction industry	Survey design with construction sector clients, managers, architects and engineers	Questionnaire responses N =493 (response rate 4%)	Government officials, contractors and sub-contractors engage in many but different forms of corruption, which are most prevalent during the bid evaluation and tendering phases. Lack of confidence in the criminal justice system, a belief that no action will be taken, and a perception that whistle-blowers are not adequately protected are identified as barriers to anti-corruption measures	The research focuses on how different project actors perceive corruption in construction projects. ➢ Knowledge of anti-corruption measures is not available
(Damoah and Kumi, 2018) International Journal of Managing Projects in Business	Investigates the factors that cause government construction projects' failure in Ghana	Sequential multi-method design: In-depth semi-structured interviews and questionnaire survey	16 interviews: 7 Project Management professionals, 4 contractors and 5 clients. 230 usable questionnaires out of 500 distributed	Political interferences, delays in payment, partisan politics, bureaucracy, corruption, inadequate supervision, lack of commitment by project leaders, poor planning, starting more projects than the government can fund and change in government cause construction projects' failure	The research focuses on factors that cause project failure, and corruption is one of the emerged factors. ➢ Knowledge of anti-corruption measures is not available
(Damoah et al., 2018) Project Management Journal	Analysis of corruption impacts on the failure of government projects in Ghana	Semi-structured interviews	30 interviews: clients (5), contractors (6), practitioners (14), and the general public (5)	Different forms of corruption drive project failure (e.g., overrun schedule & cost, abandonment, stakeholder dissatisfaction) at the individual-, organisational- and institutional-level	The research focuses on how corruption impacts construction projects. ➢ Knowledge of anti-corruption measures is not available
(Ling et al., 2014) International Journal of Project Management	Comparative analysis of drivers and barriers to adopting relational contracting practices in public construction projects in Beijing and Sydney	Survey research design focusing on construction sector professionals	Structured questionnaires from Beijing, N = 59 (out of 259) Structured questionnaires from Sydney, N = 30 (out of 322)	Lack of training and lack of initiative in Bejing hinder the adoption of relational contracting practices. Public sector accountability is recognised as a barrier in Sidney.	The research focuses on barriers and drivers of relational contracting practices, and corruption is one of the barriers. ➢ Knowledge of anti-corruption measures is not available
(Locatelli et al., 2017) International Journal of Project Management	Analyses the impact of a corrupt context on megaproject's delivery and outcome using Italian high-speed railways	Single case study of Treno ad Alta velocità High-speed railway programme	Secondary data: Italian parliamentary enquiry	Corruption is harmful to both project management success and project success: Overbudget, overrun schedule, fails to deliver expected benefits, sub-optimal allocation of resources	The research focuses on the impact of corruption in large infrastructure projects. ➢ Knowledge of anti-corruption measures is not available
(Osei-Tutu, Badu and Owusu-Manu, 2010) International Journal of Managing Projects in Business	Analyses corruption practices inherent in public procurement of infrastructure projects in Ghana	Literature review: a multi-stage critical review of pertinent literature	Two public documents: 2007 Annual Report of the Public Procurement Authority, and Public Procurement Act, 2003 (Act 663)	Conflict of interest, bribery, embezzlement, kickbacks, tender manipulation and fraud are observed corruption practices in the delivery system of Ghanaian infrastructure projects	The research focuses on corruption practices in construction projects. ➢ Knowledge of anti-corruption measures is not available
(Owusu et al., 2019) Project Management Journal	Analyses and develops anti-corruption measures to mitigate the pervasiveness of corruption in construction project management	Systematic literature review: a two-stage process	38 articles published in relevant project management journals	Findings comprise 6 constructs about anti-corruption measures, each including multiple indicators. Six constructs are regulatory, managerial, probing, compliance, promotional and reactive measures	The research focuses on anti-corruption measures in construction projects. ➢ Knowledge of the effectiveness of such anti-corruption measures is missing
(Sonuga, Aliboh and Oloke, 2002) International Journal of Project Management	Analyses the root causes and possible solutions of abandoned large-scale water supply and irrigation projects in Nigeria	Multiple-case study design (2): The Zobe Water Supply Project and The Hadejia Valley Irrigation Project	Not reported	Inadequate sources of funding, price variation and corruption influence the delivery of projects negatively. Definition of alternative sources of funding phased completion of projects, and the review of specific clauses in the Particular Conditions may help overcome the above barriers	The research focuses on general barriers and remedies of construction projects. Corruption is one barrier, but only general remedies are offered for all barriers. ➢ Sufficient details of remedies are unavailable to understand their role as anti-corruption measures
(Walker and Lloyd-Walker, 2014) International Journal of Managing Projects in Business	Analysis of ethical dilemmas faced by client-side project management employees of a large Australian University	A single-case study design	Four interviews with the director, a programme manager, a project manager and the client	Four ethical dilemmas were uncovered: (1) fraud/bribery/corruption, (2) favouritism and special treatment, (3) occupational health and safety and duty of care, (4) professionalism and respect for others	The research focuses on the ethical dilemmas of project management, and corruption is one of the identified dilemmas. ➢ Knowledge of anti-corruption measures is not available
(Wang et al., 2019) International Journal of Project Management	Analyses the effect of risk transfer on private investment in PPP markets in developing countries and the moderating role of the governance environment	Statistical analysis of the World Bank's Private Participation in Infrastructure database using censored regression modelling	4560 PPP delivered in 138 developing countries from 2001 to 2015	Findings show that government effectiveness, control of corruption, the rule of law and regulatory quality reduce the negative influence of risk assumed by private partners on private investments	The research focuses on risk transfer on private investments in construction projects, and control of corruption is used as a moderating variable. ➢ Sufficient details of 'control of corruption' are unavailable to understand its role as an anti-corruption strategy

Appendix A2. Examples from the final data and coding structure.

29(40)

Bibliographical information	Context: Geographical area	Context: Industrial sector	Context: project size	Intervention: empirical label	Intervention: description	Intervention: Category	Intervention: Level	Mechanism: description	Outcome: Intended purpose	Outcome: corruption level	Outcome: Impact	Outcome: Category
Olken, B. A. (2007). Monitoring corruption: evidence from a field experiment in Indonesia. Journal of Political Economy, 115(2), 200-249.	Asia	Infrastructure	Regular	Increasing local community participation in project meetings	An experiment to enhance local community participation at the village-level 'accountability' meetings where project officials account for how they spent project funds. Hundreds of invitations were distributed throughout the village to encourage direct participation in the monitoring process and reduce elite dominance. The invitations increased the number of people participating in the accountability meetings by about 40%	Probing measures	Project	The participation experiment—the invitations—was associated with much smaller and statistically insignificant average reductions in overall missing expenditures. The idea behind community monitoring is that while the village implementation team has incentives to steal from the project, the village would benefit from the higher road quality associated with less corruption. The intervention did raise community participation in the monitoring process. Moreover, villages in the invitations treatment were more likely to openly discuss corruption problems at the accountability meetings, and villages receiving both invitations and comment forms were more likely to take serious action at the meeting to resolve corruption-related problems. However, the magnitude of these changes in behaviour at the meetings was small, and these treatments did not measurably reduce overall missing expenditures.	Inhibit project officials from embezzling project funds (measured as missing expenditures)	Major	Increasing grassroots participation in project meetings had no average impact on reducing missing expenditures	Ineffective
Olken, B. A. (2007). Monitoring corruption: evidence from a field experiment in Indonesia. Journal of Political Economy, 115(2), 200-249.	Asia	Infrastructure	Regular	External governmental auditing	An experiment where external government auditing took place in village road construction projects, and project officials were informed beforehand that auditing will take place during the project.	Probing measures	Project	Auditing treatment was associated with reductions in missing expenditures of about eight percentage points. These reductions came from reductions in both unaccounted-for materials procured for the project and unaccounted-for labor expenditures. However, the number of project jobs given to family members of project officials actually increased in response to the audits, which provides suggestive evidence that alternative forms of corruption may be substitutes. While the auditors' findings are positively correlated with the findings from this independent studyy, in the vast majority of cases the auditors' findings were procedural in nature, and not the sort of "caught-red-handed" evidence that could be used to prove criminal malfeasance. This may help explain why almost 20 percent of expenditures were still unaccounted for even in villages facing a 100 percent probability of an external government audit.	Inhibit project officials from embezzling project funds (measured as missing expenditures)	Major	Auditing treatment was associated with reductions in missing expenditures of about eight percentage points	Effective

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