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Barriers Affecting the Effective Application of Anti-Corruption Measures in Infrastructure Projects: The Disparities between Developed and Developing Countries

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Abstract

This study examines the critical barriers that obstruct the full potency and the intended effectiveness of anti-corruption measures enforced to mitigate the pervasiveness of corrupt practices in project procurement and execution. To achieve this aim, a comprehensive review of literature was conducted and resulted in the identification of 17 critical barriers. A questionnaire survey was conducted with 65 experts from around the world involved in infrastructure project procurement and management using the purposive sampling technique. The analysis was conducted on a contextual comparative basis. Thus, comparing the views of experts from the developed countries against the experts from the developing countries. The leading barriers identified by the respondents from the developing context were; the absence of political will by government officers, and statutory professional councils to fight corruption and personal attitudes which include the lack of will to become involved in fighting corruption. The respondents from the developed world revealed that, non-familiarity with ethical codes, the fear of being caught reporting and personal attitude were the leading barriers. The Mann-Whitney U test was employed to analyze the statistical difference regarding the barriers' criticality between the two contexts. This study contributes to a deepened understanding of corruption by examining the criticalities of barriers to the effectiveness of anti-corruption measures which have not received the needed attention in the past years. The study also reveals that the prevalence of corruption in infrastructure projects are not attributed to the causes and vulnerabilities only, but also the identified barriers. As this study informs policymakers, anti-corruption institutions, academic and industrial researchers on the barriers that are

likely to be encountered in enforcing and applying the stipulated anti-corruption measures, it is as well intended to contribute to the strategic development of a more holistic approach in annulling corrupt practices in project procurement and execution.

Keywords: Global Corruption, Barriers, Infrastructure procurement, Project and organizational management.

Introduction

Are anti-corruption strategies nouns or verbs? Are they mere stipulations coded down in writings or action words that are meant to be executed? Why do some measures seem to be of no effect in some contexts such as the developing countries and especially in construction management and infrastructure procurement? And lastly, why are some developed countries (such as Italy and Greece among others), who are assumed to stand a better position in fighting corruption plagued with the proliferation of corrupt practices? These are just a few of endless questions concerning corruption that are frequently asked. However, most of these questions remain unanswered even though there have been tremendous improvements regarding research on the subject matter. Corruption continues to be one of the topmost barriers to socioeconomic developments and has lived with mankind for the past five millenniums. Noonan (1984) reported that the first form of corruption, bribery, was first reported and recorded 3000BC. Despite the proliferation of corrupt practices in the public and private sectors which include the procurement and engineering sectors, the needed pragmatic efforts towards the abatement, extirpation and the prevention of corrupt practices in infrastructure projects have been enforced by several public entities and institutions such as procurement boards and authorities in diverse contexts. However, the effectiveness of these measures remains questionable (Shan et al. 2015a; Owusu et al. 2017; Ameyaw et al. 2017; de Jong et al. 2009).

Anti-corruption measures in this context can be defined as the realistic, systematic and strategic measures developed, enforced and applied to mitigate or expunge the pervasiveness of corruption and its detrimental effects in the supply chain of infrastructure procurement and the management of project execution. Some studies have reported on the susceptibility of the procurement stages to the incidence

of corrupt practices (Tabish and Jha 2011; Locatelli et al. 2017), especially in public infrastructure procurement. Moreover, due to the large sums of monies and resources expended in infrastructure projects coupled with its complex nature, the procurement process has been tagged as the most vulnerable process to corruption globally (Krishnan 2010; Chan and Owusu 2017; Transparency Iinternational 2005). Right from the conception stage where the requirements of a project are defined through to contract close-out, diverse forms of corrupt practices are recorded such as clientelism, solicitation, bribery among others (Chan and Owusu 2017). Researchers and policymakers have contributed immensely towards the investigations of leading topical constructs regarding corruption in construction project management such as forms and causes of corruption, risk indicators and anti-corruption measures. This has therefore contributed tremendously to the body of knowledge concerning corruption research in construction project management. The developments or formulations of effective anti-corruption measures, therefore, tend to focus on the inferences of the identified constructs. It was somewhat surprising to discover that only a handful of studies that have highlighted or made mention of some barriers that hinder the practical applications of developed and enforced measures without any thorough empirical justifications. Therefore, whereas no empirical investigations on this subject matter are available, 19 studies (Table 1) have either directly or indirectly pointed out some encountered obstructions that derail the full potency during the enforcement and application of developed measures in diverse contexts. Owusu et al. (2017) and Le et al. (2014a) pointed that most enforced anti-corruption measures would have achieved tremendous results should there be appropriate measures to check the barriers that hinder their effectiveness. The mentioned studies moreover recommended that future research regarding anti-corruption measures in construction management studies should pay critical attention to exploring these barriers as that will contribute to the development of more stringent and strategic anti-corruption measures towards the expurgation of corrupt practices in public infrastructure procurement and construction project management.

This study, therefore, examines the critical barriers that obstruct the intended effectiveness of anti-corruption measures developed overtime to mitigate corrupt practices in construction project management. To realize this aim, the following objectives were set: (1) conduct a comprehensive review

to identify the prevailing barriers that hinders the effectiveness of anti-corruption measures; (2) examine the criticality of the identified barriers in the context of the developed and developing countries; (3) investigate the statistical differences of the barriers' criticality in the aforementioned contexts; (4) determine the relational constructs for the identified variables to facilitate easy identification of the prevailing barriers as well as any possible or anticipated future discoveries. This study primarily contributes to a deepened understanding of corruption research in construction project management especially under the construct of anti-corruption research. The findings reveal the criticality of the identified barriers and serve as a knowledge base for practitioners, policymakers, anti-corruption institutions, academic and industrial researchers to incorporate or refer to during the development of anti-corruption measures. Thus, rendering tremendous support to the enhancement of already existing or yet-to-be developed anti-corruption measures to guide the day to day procurement, execution and management of construction and other infrastructure related projects. Recommendations for future research are stipulated in the latter section of the study.

Anti-corruption Efforts and Identification of the Barriers

Notwithstanding the efforts undertaken by individual countries to annihilate the menace of corruption with its accompanying detrimental effects in construction project management, top global institutions have as well aided in combating corruption not only in public or political sectors but also in private sectors and institutions (Owusu et al. 2017). Efforts towards the development of realistic anti-corruption measures are initiated, implemented and enforced consistently to yield the desired results of mitigating corruption (Shan et al. 2015a). However, one of the many queries raised on the topic of corruption lies in the effectiveness of anti-corruption measures that are developed and enforced to tackle diverse forms of corrupt practices in different contexts (Ameyaw et al. 2017; Le et al. 2014a, b; Owusu et al. 2017). From the perspectives of industrial and academic researchers, some of the anti-corruption measures developed to check corruption in project management include: increase in accountability, comprehensive rules and regulations, effective investigation and court proceedings, departmental disciplinary action and rigorous supervision among many others (Zou 2006; Suen et al. 2007; Tanzi 1998; Shan et al. 2015a,b; Hawkins and McKittrick 2012). Moreover, the contributions from top global

organizations include International Organization for Standardization (ISO) 37001 document, also known as the Anti-bribery management systems (ISO 2016; Global Infrastructure Anti-Corruption Centre (GIACC) 2016), Transparency International's Project Anticorruption System (Boyd and Padilla 2009), FIDIC's Business Integrity Management System for consulting firms among many others (Krishnan 2009; Boyd and Padilla 2009). However, despite the efforts and inputs from all these units, corruption continue to be prevalent in construction and other infrastructure related projects and their management especially in the context of the developing world. This is reported to be partly attributed to the factors that impede their full functionality after enforced into effect. Even though not many, the limited number of studies that have been conducted on this subject reveals critical barriers that are worth the need for thorough explorations to come up with means with which they can be thwarted. This is as well envisioned to facilitate the development of new or strategic modifications of existing anti-corruption measures towards the fight against corruption in construction project management. This study therefore intends to commence the discussion and encourages significant contributions in the future studies on the topic.

As it may be inferred from the previous section, barriers against the effectiveness of anti-corruption measures in this context can be defined as the hindering factors that impede the effective enforcement or application of the anti-corruption measures that are already in existence and these barriers to an extent. One of the initial studies to report on the barriers in the area of construction management was conducted by Bowen et al. (2012). The study examined the experiences of construction professionals and clients in the South African construction industry. The respondents who participated in the study shared their sentiments on the procedural difficulties in applying the stipulated anti-corruption measures in South African construction industry such as reporting of corrupt cases. Among the many recorded and reported barriers included structural and political barriers coupled with a number of psychological constraints which included an induced fear of victimization, social misrepresentation, fear of being marginalized, social or occupational stigma and rejection among many others (Table 1; appendix 1 and 2). Ameyaw et al. (2017) also explored the pervasiveness of corruption in the Ghanaian construction industry, and one of the listed constructs in their study explored the factors that cause prevailing anti-corruption measures to be ineffective. Barriers such as fear of insecurity which

includes fear of losing job, and personal attitude, for example, lack of will to become involved in fighting corruption among others were identified. Other studies have as well highlighted or reported similar constraints in different contexts. All the identified barriers the valid publications have been summarized and presented in Table 1. Table 1, therefore presents a total of 17 barriers to effective anti-corruption measures identified in literature after a comprehensive and a systematic approach in selecting the needed valid papers as well as extracting the barriers from the retrieved publications.

Even though few papers have made mention of anti-corruption barriers in one way or the other, no study has thoroughly reviewed or empirically examined the criticality of these barriers as a lone construct or subject matter and how they pose threats to the development, enforcement, and application of anti-corruption measures under the domain of corruption-related research in construction management (Bowen et al. 2012; Owusu et al. 2017). This study aims to fill this gap but focuses on the examination on the prevailing critical barriers on a broader perspective involving experts from the developing and developed economies. Due to the reports that different regions are plagued with different forms of corrupt practices (Chan and Owusu 2017; Tabish and Jha 2011; Shan et al. 2015a), there should be variations in the developments, enforcement, and applications of different forms of anti-corruption measures. This as well constituted one of the rationales for conducting the study by drawing on the experiences on the experts from the contexts involved. Moreover, as different countries may be exposed to different barriers due to the differences in the degree of corruption pervasiveness and the control efforts, there is the need for comprehensive individual assessment of the barriers inhibiting the effectiveness of the anti-corruption measures. This will aid in the development of comprehensive anti-corruption measures. However, since the assessment and surveys on the subject matter are limited, a comprehensive literature review and analysis of the criticality of the barriers against the anti-corruption measures effectiveness from the viewpoints of global experts representing both the developed and the developing worlds is worth undertaking. The succeeding sections, therefore, reveal the criticality of the identified barriers in the contexts above.

[INSERT TABLE 1 AROUND HERE]

[INSERT TABLE 2 AROUND HERE]

Table 2 and Figure 1 present additional information on the papers reviewed for this study. Table 2 presents information on the lists of authors for each study including their respective journal and associated publishers' names, the type of study undertaken (whether review studies or case studies and empirical studies) and the associated methodologies employed to execute the aim and objectives for each study, the number of respondents for each study and the context or origin of the study. Figure 1 on the other hand, presents a graphical view of the publication trend of the papers selected.

[INSERT FIGURE 1 AROUND HERE]

Research Design

Questionnaire Design and survey

The primary data instrument used to solicit respondents' personal experiences, and their opinions on the subject matter was questionnaires. This data collection method was adopted since it provides reliable and valid information within a manageable or relatively shorter timeframe at a reasonable cost (Ameyaw et al. 2017; Hoxley 2008). The use of questionnaires often ensures respondents' anonymity and data confidentiality especially on sensitive matters such as unethical practices in the management of construction and engineering projects and corruption (Chan et al. 2017). The variables encapsulated in the questionnaire was derived from the extensive literature review conducted prior to the survey. The 5-point grading scale system was adopted, and the respondents were asked to grade the identified barriers from the degree of 1 (not critical) to 5 (extremely critical) and as well provided additional rows (for optional open-ended responses) to insert any known barriers that were not captured in the literature review.

Survey Participants

At the end of the survey, a total number of 65 valid responses were regarded suitable for further analysis after checking, cleaning and making good any discrepancies or irregularities that affected the further processing of the data. Table 3 and figure 2 presents the background information of the respondents and their countries respectively. The 65 respondents came from 19 different countries (9 from the developed

and 10 from the developing). However, most of these respondents happen to come from Ghana and Hong Kong. Even though this skewness may be regarded as one of the study's primary limitations, the reason why an appreciable number of responses came from these two contexts is related to the study's focus. As pointed at the acknowledgement section, this is an ongoing that research focuses on the geo-economics scopes of these two contexts as the representation of the developing and the developed regions respectively. Moreover, further responses were gathered from other experts from around the world to examine if a consensus can be determined or reached in their responses. Experts in this context refer to the respondents who were contacted and participated in the survey. They are classified as experts because of their expertise which served as the underlying indicator for selecting the respondents. The primary criteria for their selection which corroborate or justify the use of the term expert is presented in the next paragraph after figure 2. These are experts involved in the day-to-day active participation in matters and activities related to construction management and infrastructure procurement. With over 35% of the respondents having more than 20 years of experience and over 65% with more than 11 years of experience, the responses were esteemed with high relevance because of the experts' backgrounds and the results, highly reliable. The Cronbach's alpha in each context (i.e., developed and developing) confirm this proposition of data reliability. Even though the respondents were assured of data confidentiality, most were unwilling to participate in the survey due to the sensitive nature of the topic under study and to avert any anticipated reprisal in the future. However, the number of responses gathered were deemed adequate and suitable for further analysis after the necessary pretests.

[INSERT TABLE 3 AROUND HERE]

[INSERT FIGURE 2 AROUND HERE]

As presented in table 3, the respondents selected for this survey come from diverse background from the field of infrastructure procurement and management. They are mostly composed of senior experts involved in the procurement and management processes of construction works. However, to arrive at the selection of suitable respondents for this study, a number, a purposive sampling approach was adopted to identify experts with thorough knowledge and experience in the procurement process for

construction and other large-scale infrastructure related works. The primary criteria for selecting the participants or in this context, experts, were based on two established factors drawn from the purposive sampling approach. They are: 1) The main prerequisite for the selection was pointed to the participants with thorough knowledge and experience in the procurement process for construction and other large-scale infrastructure related works; and 2) They should have extensive theoretical and experiential knowledge of the dynamics of corrupt practices. Therefore, because this condition was stated in the preamble of the questionnaire, a number of proposed contacts who were contacted to partake in the survey declined their participation since they could not fulfil the conditions. Others also returned the questionnaires unanswered. These selected respondents were also requested to help disseminate the questionnaires to anyone they know with similar background. Over 300 questionnaires were distributed online. However, the exact number of total respondents (including, respondents who received the questionnaires from their colleagues) cannot be accurately estimated due to the fact that other experts invited by the firsthand respondents may not be accurately estimated. Some of the questionnaires were as well retrieved as collective views of experts working in a single institution. In this scenario, a single question was presented to represent the views of a large group of experts and institutions.

Because the questionnaire stated in the preamble, the prerequisite to partaking in the survey, a number of questionnaires retrieved were unanswered and thus discarded. Moreover, since the study discusses quite a sensitive issue and coupled with a comprehensive questionnaire, the authors were advised to limit the questions of the both the areas under investigation and the background information of the respondents once they qualify the prerequisite clause and further authenticated by a valid organizational email address since the questionnaires were distributed online. For instance, experts from the Organization for Economic Cooperation and Development (OECD) had their emails such as abc@oecd.org. Others from the World Bank and the United Nations involved in construction and procurement works including Consultants of Roads and Transport Infrastructure were as well regarded valid after confirming from their emails or individual signatures at the end of their email responses. Additionally, academics who are involved infrastructure projects and had thorough knowledge on the dynamics of unethical practices such as corruption and their relationships with construction and the procurement process were contacted as well. They were mostly identified by virtue of their publications

on the subject matter coupled with their experience in professional practice. Lastly, with the years of experience capped at 20 years or more, it was discovered by further exploration about the respondents' background that some of the experts within year range of above 20 had over 40 years of experience as industry experts and academics.

The background information of the experts is presented in Table 3, and their respective countries are presented in figure 2. However, their respective detailed background information cannot be reported in this study due to two reasons: 1) The experts were assured of the protection of their biodata albeit the basic information about them could be reported and 2) the duty of care on the side of the authors to keep the promise made to the respondents concerning their biodata confidentiality. On a general scale, a sample size of 65 is adequate to draw significant conclusions which this study offers especially regarding a sensitive subject area of this nature.

Data analysis and survey results

The gathered responses were subjected to descriptive and factor analysis to explicate and disclose the depth of the issue under study since it represents the first empirical study to report on this subject related to barriers that adversely affects the effectiveness of anti-corruption measures. The mentioned tools were adopted based on their ability to realize the objectives of the study. Other justifications for the adoption were attributed to the associated advantages over other tools and their wide adoption and use in other construction project management and corruption related studies as listed in the succeeding sections. The succeeding sections present the statistical results in detail. The gathered data were analyzed using the twenty-third version of the Statistical Package for the Social Sciences (SPSS) and Ucinet version 6.585. The data was first examined to determine its appropriateness and reliability prior to further analysis as that constitutes a requirement to enhance the justifications for the results. The reliability test was therefore conducted in this study using the Cronbach's Alpha test tool in SPSS. As extensively employed in different studies and especially in construction management related research, the Cronbach's Alpha tool was employed in this study to perform the mentioned tasks. Given the two divisions of the total sample (i.e., 33 for developed and 32 for developing), the test was performed on each group since most of the analysis and discussions were made on comparative bases (i.e., between

developed and developing countries). Complying to a scale from 0-1 where 0 represents no reliability, and 1 stands for full reliability, the closeness of the alpha value to 1 depicts an increasing level of reliability and vice versa with a given threshold of 0.7 (Chan et al. 2017; Santos 1999). The respective alpha values in each context are presented in Table 4.

Data Normality and Degree of Criticality Test

Another important test to determine further necessary tests and suitable tools to be employed after determining the reliability of the data was the normality test. The normality test demonstrates the nature or type of data distribution (Darko et al. 2017). Therefore, whereas a normally distributed data may require parametric tests such as 2-sample t-test, non-normal distributed data require non-parametric tests such as the Mann-Whitney U test as conducted later in this study. The determination of data distribution is, therefore, a required step to be conducted especially when the researcher is not sure about the nature or type of data distribution. The common test performed to determine data distribution is the Shapiro-Wilk test (Gel 2017). The null hypothesis stipulates that: "the data is normally distributed." Using a common significance level of 0.05, the null hypothesis is rejected if the calculated Shapiro-Wilk test is lesser than the stipulated p-value. Thus, concluding that the pattern of data distribution is non-normally distributed. The overall statistical results of the Shapiro-Wilk test is presented in Table 4. In accessing the criticality of the barriers, the mean score technique was adopted. The MS was regarded as the primary tool to demonstrate the level of criticality (i.e., how a barrier is critical than another in each context). The ranking of the barriers was therefore based on the mean difference. Using the ordinal measurement from 1 to 5 as the lowest to the highest means respectively, the respective ratings of the respondents were therefore defined from 'not critical' to 'extremely critical,' and per the ratings, the barriers with relatively higher mean values (i.e., from 3.5) were considered critical.

Contextual Disparities test

The Mann-Whitney U test is recognized to be one of the most useful and widely adopted nonparametric techniques in assessing the significant difference or assigning a statement of probability to the

difference between two samples that are independent of each other (McKnight and Najab 2010; Osei-Kyei and Chan et al. 2017). A countless number of construction management related studies have also employed this statistical tool to determine significant differences on different topics in diverse context and between different categories of stakeholders and usually in the classes of twos (Chan et al. 2017). Therefore, to determine the significant statistical disparities regarding the criticality of the barriers in the two regions as expressed by the experts, the Mann-Whitney U test was employed to execute this task. As a flexible tool, the Mann-Whitney U test requires no prior supposition on the distribution of data. Moreover, the number of respondents of the representative groups can as well be varied (Darko et al. 2017). In employing the Mann-Whitney U test, the null hypothesis states that "there is no difference regarding the levels of criticality of barriers between the two contexts." The null hypothesis can, therefore, be rejected upon the identification that the individual significance levels exceed the critical alpha value (0.05). The test results for the identical comparisons of the variables are presented in Table 4.

Factor Discussions

Factor Analysis technique was applied to explore determine the underlying categorized variables that represent the barriers against anti-corruption measures (ACM)identified in this study, and it forms the bases for the constructs' discussions. It is considered as a statistical technique commonly adopted to determine a relatively fewer constructs' categorization underlying a set of correlated items or variables (Norusis 2008; Mooi et al. 2018). It is regarded as a powerful tool employed to categorize a large number of variables into fewer and more significant constructs by factor points of responses as well as establishes the least number of categories that quantify for the maximum variance in a set of data (Pallant 2011). There are two important stages involved in the application of the factor analysis technique namely factor extraction and rotation. However, to test the appropriateness of a given data for factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were conducted (Chan et al. 2017; Le et al. 2014b). The KMO measures the sampling suitability or adequacy that depicts the ratio of the squared interrelationship between the composing variables to the corresponding squared partial correlations. With a given range of 0-1, a zero KMO

indicates a diffused correlated pattern which renders the dataset inappropriate for factor analysis and inversely, a KMO of 1 depicts compactness of correlated patterns, thus renders the dataset apropos for further analysis. However, per the stipulations of previous studies, any KMO above the threshold of 0.5 is often considered satisfactory for factor analysis to proceed (Zhang et al. 2016). The Bartlett's sphericity test on the other hand tests for the variance homogeneity. Therefore, when the value for the sphericity test statistic is relatively larger with a corresponding lower significance level, the population correlation matrix is not an identity matrix which indicates that the factor model is appropriate (International Business Machines (IBM) 2108; 2108; Pallant 2011).

[INSERT TABLE 4 AROUND HERE]

[INSERT TABLE 5 AROUND HERE]

Results and Discussion

Criticality of Individual barriers of both contexts

It was not surprising to notice that the factors received relatively lower ratings by the respondents from the developed world. Table 3 presents the individual ratings for the barriers for both contexts as well as the amalgamated results of the two contexts (i.e., the overall column). All the individual ratings from the developed world experts were approximated to be either neutral or less critical as predefined by the Likert scale. However, despite the low ratings, it is not unnecessary to highlight the factors that received high rankings regarding the position or how the experts view these barriers. Therefore, the experts from the developed world share a common consensus that the knowledge gap or non-familiarity with organizational stipulations that concerns corruption, transparency and the sense of creating an ethical atmosphere is considered to be the leading barrier that limits the potency of anti-corruption measures in infrastructure projects in the developed context even though it had a lower rating with a mean value of 3.10. This is interpreted from the context of not just knowing the ethical codes but also knowing what ought to be done and not doing it (Owusu et al. 2017, Zhang et al. 2016; Le et al.2014b).

This may relate to one of the critical barriers observed in the case of the developing countries as well. On other occasions, since some parties may already know the punishments that are meted out

in the case of any corrupt activity, the motivation to indulge in a corrupt act outweighs the fear after weighing the advantages and risks involved in whether to indulge in a corrupt activity or not. Therefore, just like in the case of investments, the portfolio that offers a high rate of return is worth investing in. Thus, parties may get involved because of the projected high rate of returns coupled with the low risk of getting caught or reported. Other leading barriers included the fear of being caught reporting, [BAC6] which came second with a mean score of 3.10, inappropriate staffing [BAC15] and the lackadaisical attitude of some parties of employees towards corrupt practices, for example, lack of will to become involved in fighting corruption [BAC17], both placed third with a mean score 3.00 each. It was, however, quite startling to notice that fear of being caught reporting would be regarded as one of the top three barriers in the context of developed countries despite the practical measures implemented to ensure safe and efficient reporting of corruption cases in the developed world. However, per the consensus of the experts involved in this survey, the perception that a low-ranking official may incur sanctions by a supervisor, after the supervisor has managed to defend his way out in an event of a corruption case induces or creates a sense of fear and as a result cause the subordinate to keep mute even in the event of a corrupt practice. Even though this may not be the case of every developed country, the respondents identify this factor with other leading factors to be the cases to investigate since they have the potential to elevate from the neutral levels to critical levels if proper measures are not taken to expunge these barriers.

In the case of the Developing world, corruption continues to hit the headlines on daily bases with confirmations from the reports of top global indexes such as the corruption perception index by Transparency International, the Worldwide Governance Indicators by the World Bank, the Global Competitiveness Index by the World Economic Forum among many others. The situation of corruption in the developing world does not seem to improve, and in some cases, the reports indicated above reveals the declination in performance by most countries in the developing world as well as the challenges that impede the progress or developments towards the expurgation of corrupt practices. Not contradicting this background, it is worthy to note that most countries have taken great initiatives and tremendous efforts by developing and enforcing practical measures to curtail corruption. However, just as described in the previous sections, it is in these instances that these barriers also emerge to hamper

the effectiveness of the stipulated anti-corruption measures. Moreover, most developed anti-corruption measures do not cater for the barriers that hamper their effectiveness but are rather concentrated solely on eliminating the forms, causal factors and the identified risk indicators involved. It is therefore needful, to create a pragmatic and holistic approach in dealing with corruption-related issues. Thus, encapsulating all the mentioned constructs of corruption as well as supplementary incorporations of strategies to deal with anticipated barriers against anti-corruption measures. The leading barriers that emerged in the case of the developing context were political barriers as they were recognized in their individual criticalities and also as a construct as discussed later in this study. Lack of political will by government officials and statutory professional councils to fight corruption [BAC13] as well as political and structural barriers [BAC1] came first and third place respectively with their corresponding mean scores at 4.09 and 4.00. Since the factor analysis clustered these two variables into a single construct, a detailed discussion on these two variables are given at the construct criticality section. Personal attitude, for example, lack of will to become involved in fighting corruption [BAC17] was identified to be the second critical barrier in the developing world context with a mean score of 4.03. Just as Boyd and Padilla (2009) pointed that whenever there is a case of corruption, the key identified parties include the demand side (the party that calls for the corrupt act to be done), the supply side (the party that pays or offers the price for corruption) and the condoning side (the party that remains silent in the case of corruption). BA17 concerns or correlates most with the third party (i.e., the condoning side). Even though society may frown upon this act; it should be noted that some studies point out the justifications with which some people decide to fall into the category of the condoning side (Boyed and Padilla 2009). Owusu et al. (2017) indicated that some of the general factors with which the condoning parties stand on to justify their actions may stem from the lack of trust in the context in which they work; the presumption that no better results will evolve even in the event of reporting; the associated risks attached to the disclosure of corrupt acts in a given context; and the perception that no disciplinary actions will be taken against the culprit after reporting. Therefore, to be in an undisturbed zone, the condoning party may opt to remain silent in the event of a corrupt activity. Other factors such as the dread of being victimized, the fear of being marginalized, social or occupational stigma and rejection contribute to

condoner's justification to keep silent during the event of corruption related to loyalty to friends and organizations (Shan et al. 2015a; Ameyaw et al.2017; Bowen et al.2012).

Individual Comparability

As pointed in the previous section, the Mann-Whitney U test was conducted to determine the statistical differences of criticality between the identical barriers of the two contexts (i.e., developed and developing). The test was performed to identify the relative degree of differences with which the barriers are viewed or deemed critical in each context. With the prior supposition or null hypothesis stating that there is no difference in terms of the degree of criticality concerning the barriers, the null hypothesis were rejected in all cases except for BAC8, BAC11, BAC15 and BAC16 where the significant values exceeded 0.05 (meaning there is no significant statistical difference in the mentioned variables). The Mann-Whitney U test results partly confirm the reports on the perception of corruption prevalence and control in these two contexts by world reports stated earlier even though the results in this study are more skewed towards the field of construction management and infrastructure procurement. The experts from the two different regions, therefore, attest to the notion that there are differences regarding how the identified barriers affect the modus operandi of construction project management. This is indicated by the mean values in each context coupled with the Mann-Whitney U test results. That is, whereas respondents from the developed context attest to the low or neutral levels of criticality of all the barriers, most of the barriers were identified to be critical in the context of the developing world. Thus, confirming a sharp statistical distinction of the barriers in the two contexts as revealed by the Mann-Whitney U test.

Factor and Network Analyses Results

To make room for the discussion of the other constructs, factor analysis was performed to identify the statistical correlations among the variables and to categorize them into their associated constructs. Even though the factor analysis draws the significant constructs after some number necessary rotations, the network analysis amplifies the correlations by highlighting the variables' degree of betweenness and

centrality (Table 5). Table 6 presents the summary of the factor analysis results and figures 3 and 4 illustrates the graphical presentation of the network analysis results.

[INSERT TABLE 6 AROUND HERE]

[INSERT FIGURE 3 AROUND HERE]

INSERT FIGURE 4 AROUND HERE]

Even though by definition, the social network analysis (SNA) technique is supposed to depict a social structure encapsulating different individuals and in diverse context or organizations (commonly called nodes) which are connected or tied by a shared or common variables or different kinds of interdependencies ranging from kinship relationship, believes, common interests and among many others (Freeman 2011; Lin et al. 2017). Out of the several SNA technique metrics such as the clustering coefficient, eigenvector centrality, bridge, cohesion among other metrics, the four most widely adopted measures of centrality include the eigenvector centrality, degree centrality, closeness and betweenness (Scott 2017; Freeman 2011). However, this study employed two out of the four common techniques. The two techniques adopted are the degree of centrality and betweenness. These two measures of centrality were considered adequate and apropos to execute the objectives for which the SNA technique was adopted. In a nutshell even though the technique is employed to connote or represent complex set of relationship between individuals in the social structure and the different kinds of interdependence as stated in the previous paragraph, the degree of centrality and betweenness were employed in this study to illustrate the degree or extent of relationship among the variables or nodes, (i.e., barriers) under the two given contexts. With the centrality measuring the critical power of nodes based on how well they connect the network, the betweenness depicts the extent to which a node or variable lies amid other nodes of variables in the network (Scott 2017; Kim and Hastak 2018).

Even though the inference from the application of the network analysis technique is to supplement the degree of relationship presented by the factor analysis results, the conclusion drawn from this approach indicates that the elimination of one barrier can greatly influence or affect the performance of another in a given context. It can therefore be seen from figure 3 and 4 that the degree

of relationships (i.e. the degree of centrality and betweenness) of the nodes vary in the two contexts. Whereas the graphical presentation in the case of the developed world demonstrates a relatively higher degree of correlated nodes, the case is somewhat loosed in the developing world. The elimination of the nodes with high degree of centrality such as BA2, BAC11, BAC12, and BAC13 in the developed context as well as the nodes BAC2, BAC7 and BAC16 (Table 5) in the developing context will however cause a very high significant impact on the other nodes and the entire network.

In effect, the implication or inference that can be drawn is that it will be easier to eliminate these nodes barriers in the developed context due to their close connectivity and the influence of one node on the other than in developing context which depicts a relatively loosed node-connectivity in the network regarding the degree of centrality and betweenness. However, this conclusion can be regarded as a supposition until it is tested on real life project.

Construct's Criticality

The identified barriers were regarded suitable for factor analysis in both cases due to the realization of meeting the requirements which include the KMO and Bartlett's sphericity test. Both the KMO and Bartlett's Test of Sphericity of the two respective regions are presented in Table 6. The correlation matrices in both cases were identified to be nonidentity matrices, thus suitable for further analysis. The correlations among the variables were also sturdy in both contexts even though stronger in the results for the developed context than the developing. This is confirmed by the network structures in figures 3 and 4 as well as Table 4. From both figures, the correlated variables are higher in the case of the developed than in the developing. This can be explained in two dimensions namely betweenness and degree centrality. Lastly, the variances in both cases were as well adequately homogenous, hence, apropos for factor analysis. With the application of the principal components analysis coupled with varimax rotation methods, the factor analysis rotations generated three distinct components under the developed context, and four under the developing context with their respective eigenvalues and total variance explained presented in Table 6. All the generated factors in each case satisfied both the eigenvalue criteria of 1.0 as well as the total variance explained over 70% in each case (Norusis 2008).

The naming of the components was done using the common themes that run through the variables (Owusu et al. 2017; Chan and Owusu 2017).

Moreover, in the case where no common theme exists, the naming was done using a combined theme of the variables with the maximum cross factor loadings and discarding the ones with lower loading (i.e., <0.4) (Zhang et al. 2016; Le et al. 2014b). The shared themes that run through all the components were relatively similar. Moreover, a second technique to supplement the categorization of the constructs was adapted from the study of Lee et al. (2004). Since the factor analysis technique was employed to analyze the same variables under two different contexts, a higher probability of unequal generation of the components or factors was anticipated. Simply put, it was expected that should there be three constructs formed under the developing contexts, the case of the constructs development in the developed context is likely to vary. This therefore triggered the adoption of a common label for a construct that share at least two identical variables under the two different contexts. For instance, the construct labelled Social Barriers was developed in both contexts because they shared four identical variables (i.e., BA5, BA7, BA9 and BA10) together. Therefore, even though other variables were found under the same construct, in order to harmonize and structure the labelling of the factors in a systematic order, the approaches of Zhang et al. (2016) and Lee et al. (2004) among similar studies were identified to be apropos for adaption.

However, one component named psycho-political in the context of the developed countries was split into two stand-alone constructs namely phycological barriers and political barriers in the case of the developing context. In descending order, the three components in the developed context were organizational barriers with a construct mean of 2.850, psycho-political barriers and social barriers with mean value of 2.845 and 2.734 respectively. Ranking from top to bottom, the constructs developed in the context of the developing countries are political barriers with MS of 4.045, psychological barriers, social barriers and organizational Barriers with respective means of 3.618, 3.538 and 3.507. Unlike the causal factors that trigger of corruption in construction projects, the barriers to the effective enforcement and application lend themselves to administrative concerns rather than project concerns even though these barriers have either direct or indirect influences on projects.

Political Barriers

Analogous to political corruption which characterizes the abuse of delegated powers by government officials to misappropriate states funds or resources for illegitimate selfish gain, political barriers connote the obstructing measures posed by government officials (use or abuse of power) directly or indirectly to thwart the effective functioning and enforcement of anti-corruption measures (Owusu et al. 2017; Bowen et al. 2015; Zou 2006). These kinds of barriers are often critical in kleptocracy states where governments commonly account to no external authority and abuses delegated power to exploit state's resources. In effect, officials extend their power to boomerang sanctions in situations they are recognized to be offenders or culprits. This is largely identified in the procurement of infrastructure works where large sums of monies are expended. It was therefore not surprising to identify the political barriers as the leading construct to obstruct the effectiveness of ACM measures in the developing world, especially given the weak political systems in most developing countries. The leading barrier identified under this construct was the absence of political will which is explicated to be the political unwillingness by statutory councils and government officials to fight corruption since they may be involved in it one way or another. This variable had the overall highest MS of 4.09 in both contexts. The second variable in this construct is political and structural barriers with MS of 4.0. This signifies that the primary area of concern with respect to dealing with the barriers to the effectiveness of ACM in the developing world should always start from the top.

Psychological barriers

Psychological barriers happened to be one of the stand-alone constructs in the developing world context. Even though it was the least ranked construct, it had the highest number of variables per the results of the FA. Psychological barriers can be described as human-related factors (psychosomatic, mental or emotional) that affects one's behavior in a given setting and under a given condition (Owusu et al. 2017; Greitzer 2013). Therefore, the response to an act in a given situation is influenced by the psychological make-up of a person. However, one's disposition towards the fight against corruption is not only influenced by the external factors such as institutional structures but also the influence of the external factors on his psychological make-up. Studies therefore pointed that most ACMs in the context of the

developing world are not effective as they ought to be due to the psychological restraints captured under this construct (Bowen et al. 2012; Ameyaw et al. 2017).

Per the results of this study, the top three variables identified under this construct included the fear of being caught reporting coupled with the fear of insecurity which includes dread of losing one's job and the perception of no better result, distrust in system (Shan et al. 2015b; Alutu 2007; Bowen et al. 2012). The lack of trust in the governmental and institutional structures in developing countries has been one of the paramount obstructions to the effectiveness of ACMs in the developing context (Owusu et al. 2017). With the notion and perception that either less or no rigorous efforts would be taken by states to bring offenders and culprits to check put a high percentage of the general populates to either report a corrupt practice.

Other variables identified in this construct include the bureaucratic process of reporting corrupt cases, which puts reporters off since they would rather prefer to invest their time on other important matters rather than expending it in the complexities and lengthy processes of reporting corrupt cases, the inappropriate internal institutional coordination / inter agency relations and the lack of understanding and knowledge of their rights within a contractual environment, difficulty in providing concrete evidence, this factor may not be a direct barrier but rather a primary determinant or contributing factor on one's behavioral patterns (Owusu et al. 2017; Shan et al. 2017; Stansbury 2009; Bowen et al. 2012).

Organizational Barriers

The barriers that contribute to the ineffectiveness of ACMs are not only limited to political or human-related factors but also organizational or institutional factors. These are either direct or indirect factors associated with or stemming from institutions involved in the realization of construction and other infrastructure projects. The OG construct forms one of the two categories developed under the two contexts (i.e., developed and developing countries) due to the commonalities that exist between the two. Per the normalization values, this construct is highly relevant in the developed context as compared to the developing even though its MS in the developing countries is more significant as compared to the developed. It can, therefore, be considered to be relevant in both contexts as compared to the other

shared construct. The shared barriers between the developed and the developing included the lack of knowledge or non-familiarity with ethical codes/ organizational codes of ethics and Inappropriate staffing (Bowen et al. 2007; Stansbury 2009; Shan et al. 2015b). Other obstructing factors exclusive to only the developing countries included personal attitude, for instance, in a situation where people are not concerned with fighting the pervasiveness of corruption and social misrepresentation. In the context of the developed world, the organizational barriers specific to this context included the lack of understanding and knowledge of their rights within a contractual environment, difficulty in providing concrete evidence and lastly the perception of no better end result, distrust in system (Ameyaw et al. 2017; Chan and Owusu 2017; Zou 2006; Iyer and Sagheer 2009).

Psychosocial Barriers

Following the attributes of psychosocial-specific causal construct that was developed in the study of Owusu et al. (2017), the psychosocial barriers can simply be defined as the relationship that exists between the psychological attributes or behavior of a person and or on social or environmental factors. The barriers under this construct, therefore, reveal the psychological connotations of a person as influenced by the environment that causes a person to act lackadaisically towards the enforcement or application of enforced ACMs or rather disregard stipulated ACMs which in turn contributes to the pervasiveness of corrupt practices and the ineffectiveness of ACMs. Most of the social barriers against the effectiveness of anti-corruption measures exist because of the negative strings and the harmful effects attached to it. Krishnan (2009) presented several examples from different international reports on why most people fear to report corrupt cases or aid to the effectiveness of ACMs. Among the examples was death report on a civil engineer from India who blew the whistle against a corrupt act.

No one would prefer to go through such experience for reporting a case may be indirectly connected to him. However, because there may be no stringent stipulations instituted to protect whistleblowers or potential candidates who aim to help curb corruption, the situation worsens especially in the developing world. This construct was identified in both the developed and the developing world because they shared common underlying variables which are fear of victimization, fear of being marginalized, social or occupational stigma and rejection and lack of independence (Bowen et al. 2012;

Krishnan 2009). Other critical barriers identified include fear of losing life in the context of the developing world and social misrepresentation, fear of being caught reporting, and the inappropriate coordination of internal structures of an institution/ interagency relation (Ameyaw et al. 2017; Krishnan 2009; Stansbury 2009). Effective ACMs targeted at eliminating psychosocial and project-specific causal factors of corrupt practices may incorporate strategies for curbing the identified variables under this construct. original

Psycho-political Barriers

The validity of the term psycho-political was coined by Prilleltensky (2003), which was defined as a way to assess the psychological patterns of a person or a given group of people within an organization or a community and their responsiveness to and engagements with the dynamics of power, analysis of structural levels and social justice promotion. Thus, the term amalgamates the interplay of the theories behind psychology and politics and the inference of the term on human behavior towards political, structural and social stipulations and enhancements. This construct came second place with MS of 2.845. Even though the MS indicates a neutral level of criticality, the normalization value indicates a high level of significance of the construct's criticality which is 0.957. Five variables were captured under this construct and they are lack of political will, a lack of political will by government officials and statutory professional councils to fight corruption (Osei-Tutu et al 2010; Sohail and Cavill 2008), political and structural barriers (Locatelli et al. 2017; Zou 2006; Ameyaw et al. 2017; Tidey 2013), personal attitude, for example, lack of will to become involved in fighting corruption, fear of insecurity which includes fear of losing job (Krishnan 2009; Ameyaw et al. 2017; Bowen et al. 2012) and the bureaucratic process of reporting corrupt cases (Porter 1993; Tabish and Jha 2011; Sohail and Cavill 2008; Bowen et al 2012). The distinct demarcation between the two constructs lies in the notion that whereas psycho-social barriers are more centered on the correlations and the influences of psychological factors on social behavior and vice versa, the psycho-political construct, on the other hand, demonstrates the relationship and influences between psychological factors and political or governmental structures. Figure 5 presents mean indexes of the constructs developed for each context.

[INSERT FIGURE 5 AROUND HERE]

Limitations and Future Research

Analogous to other the studies developed from this data, it must be admitted that there were a number of limitations encountered. The first limitation has to do with the unevenness of the respondents' distribution across the representing countries. Even though discussions are made on both developed and the developing countries, it must be emphasized that the conclusions do not represent the general views of the overall experts from the developed or the developing world as most of the respondents in this study happen to come from Hong Kong and Ghana respectively. Therefore, any reference to the results should be relayed, conveyed or used with precaution (that is, the specified limitation encountered in this study). The skewness of the data towards these two specific regions is attributed to the fact that the authors are currently conducting a research study using these two contexts as the scopes for the ongoing research. Even though the research is still ongoing, the views of other experts, particularly from the top global organizations and academics involved in the procurement and management of construction and other infrastructure related projects were sought after and solicited to determine if there will be a level of consistency in the views of all the experts involved regardless of their nationality.

Moreover, the findings cannot be attributed to one specific country but rather serve as a point of reference in considering areas to tackle in each context regarding the expurgation of the identified barriers. It is therefore recommended that; further detailed researches be conducted in a more focused direction (i.e., institution or country-specific). This is because the barriers that affect a given context may be very much disparate from another context even in the same region. Some items may be more critical than others, and even other barriers specific to one context may be identified to exceed the seventeen barriers identified in this study. This is one of the many reasons why there is the need for a more detailed studies in specific contexts but can however, refer to this study as a reference point.

Also, it may be argued that a larger sample from wide-ranging counties could have generated more significant results. Not disputing this proposition, it is justified that the sample size is adequate and appropriate for further analysis given the initial results generated by the necessary tests that stipulates the results to be reliable and appropriate. Moreover, due to sensitive nature of the topic, and

the realization that the theme was focused on a wider perspective, experts were reluctant to share the situations from their specific countries, and only those who responded were recorded for the analysis. However, the authors believe and recommend that researchers who aim to conduct similar research in a given or specific context should solicit for more data in order to eliminate any discrepancies concerning the reliability of the data and as well yield more significant results.

From the explorations conducted, it was realized that the formulations of existing ACMs in construction management unlike other known areas such as criminology, anthropology and sociology. are based on the research and findings on the current explored constructs which include the forms of corruption identified overtime in the construction management, the underlying causal measures triggering the pervasiveness of the identified forms and the contextual risk indicators (which has also not been explored in detail) that renders construction projects susceptible to corrupt practices without considering potential barriers to their effectiveness. Therefore, whereas the causal factors are being checked with their corresponding forms, the full effectiveness of most ACMs established are not realized, thus contributing to the continued persistence of corrupt practices in construction project management, especially concerning projects in the developing world. Per the findings of the study, authors, therefore, recommend that much attention be paid to the explorations of barriers during the developments of ACMs especially in the context of the developing world and moreover, further and deeper explorations on the subject matter in different contexts is highly recommended. This will disclose more critical ACM barriers that are more specified to a given context and will, in turn, help direct the formulations of ACMs in a more focused and holistic manner. There is a need for creating a pragmatic and holistic approach to deal with corruption related issues. How to deal with corruption issue from construction project management practitioners' point of view in changing project's procurement and execution method for example. The detrimental effect of corruption on construction industry and other industries via forward and backward linkages and in turn on economic growth must be studied.

Conclusions

This study sought to conduct an empirical survey on the barriers that hamper the effectiveness of existing anti-corruption measures developed to mitigate corrupt practices in the procurement and management of construction and other infrastructure related works. The rationale stem from the reported notion that despite the good efforts in implementing anti-corruption measures to mitigate the prevalence of corruption in projects and the industry, the accounts for factors that normally obstruct the effectiveness of these measures are not fully considered (Bowen et al. 2012; Owusu et al. 2017), and literature as well remains silent on this issue even though due considerations and attention have been given to other constructs of the subject matter of corruption. Therefore, in order to aptly reach the target, four objectives were set. Commencing with a comprehensive review of previous studies on the subject matter, the second objective was to examine the criticality of the factors or variables collated during the review study with experts from different contexts (primarily segmented into emerging and established economies or jurisdictions). The results revealed the unwillingness of people to get involved in the fight against corruption represent the number one impediment to the potency of existing anti-corruption measures. Other critical factors included political and structural barriers and the fear of being caught reporting. Even though a number of constructs namely psychological, social, organizational, political and psycho-political emerged after the variables were categorized using the factor analysis technique, the root cause or rationale underpinning the unwillingness of persons to get involved in the fight against corruption needs to be examined in the future. Using a total number of 65 responses which were regarded valid for the data analysis, 33 of the responses came from experts from the developed countries and 32 from the developing. Moreover, in determining the statistical significant difference between the views of the respondents of the two contexts, the Mann-Whitney U test results indicated that four identical variables (BAC8, BAC11 BAC15, BAC16) were identified to be statistically insignificant in terms of their differences. However, the remaining thirteen variables were identified to be statistically significant regarding the differences in their levels of criticality. In essence, it can be deduced that whereas these thirteen barriers may be considered critical by the views of the respondents from the developing context, the case is somewhat different per the views of the experts from the developed context.

The practicality of corruption research aimed at annulling the menace in projects and the industry is as well hindered by these factors which this study reports (Ameyaw et al. 2017). Even though this study may be subjected to a number of limitations, there is no doubt that theoretically, it contributes to the body of knowledge on the subject matter of corruption in addition to a deepened holistic understanding of the topic of corruption in construction management research. It extends the body of knowledge by first conducting a systematic review of the barriers and empirically examines their criticality in relation to infrastructure procurement. Aside the individual levels the barriers' criticalities, the study also reveals the factors that have higher influences on factors when viewed in under the scope of their connectivity in a network. Thus, informing anti-corruption practitioners probable areas to tackle first in dealing with these barriers. Practically, as academic and industrial researchers continually develop tool kits, frameworks and policies against corrupt practices, this study is intended to extend the coverage of dealing with corrupt practices. The study practically reports on taking a further step in the approach in combating corruption by extending the scope beyond the traditional causative factors with their associated vulnerabilities to cover the barriers that impede the efficacy of existing anti-corruption measures.

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Data Availability Statement

Data generated or analyzed during the study are available from the corresponding author by request.

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Table 1: Barriers to Effective Anti-corruption measures

Code	Barriers	References																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
B1	Political and structural barriers.		x	x			x	x	x					x	x	x	x		x	
B2	Fear of insecurity which includes fear of losing job,	x													x					x
B3	Fear of losing life	x																x		
B4	Social misrepresentation,										x									
B5	Fear of being sidelined or marginalized,										x				x					
B6	Fear of being caught reporting,	x					x													
B7	Social or occupational stigma and rejection,										x							x		
B8	Bureaucratic process of reporting corrupt cases,				x						x				x					
B9	Lack of independence										x									
B10	Fear of victimization,										x									
B11	Inappropriate co-ordination of internal structures of an institution/ interagency relation				x								x		x					
B12	Perception of no better end result, distrust in system,						x				x									
B13	The lack of political will by government officials and statutory professional councils to fight corruption.	x			x						x			x	x		x			
B14	Lack of knowledge and understanding of their one's rights within a contractual environment coupled with the difficulty in giving tangible evidence in the event of corrupt activity.										x		x		x					
B15	Inappropriate staffing				x										x					
B16	Lack of knowledge or non-familiarity with ethical codes/ organizational codes of ethics	x				x		x				x			x					
B17	Personal attitude, for example, lack of will to become involved in fighting corruption.	x			x		x			x										

1 = Ameyaw et al. (2017); 2 = Tabish and Jha (2011); 3= Locatelli et al. (2017); 4= Owusu et al. (2017); 5= Chan and Owusu 2017) 6 = Bowen et al. (2007). 7= Zou 2006; 8 = Le et al. (2014b); 9= Porter (1993); 10 = Bowen et al (2012); 11= Iyer & Sagheer (2009); 12 = Stansbury (2009); 13 = Osei-Tutu et al (2010); 14 = Shan et al. (2015a); 15 = Shan et al. (2017); 16 = Sohail and Cavill (2008); 17 = Krishnan (2009); 18 = Tidey (2013); 19 = Alutu (2007)

Note: Please refer to Table 2 and Figure 1 for further details of the references.

Table 2: Information on selected papers

No.	Journal/Publisher	Year	Authors	Type of study	No. of respondents	Study context	Methodology
1	JME, ASCE	2017	Ameyaw, E. E., Pärn, E., Chan, A. P., Owusu-Manu, D. G., Edwards, D. J., & Darko, A.	Empirical	35	Ghana	Descriptive (Mean Scores and Frequency), purposive
2	CME, Taylor and Francis	2011	Tabish, S. Z. S., & Jha, K. N	Empirical	6	India	Delphi approach Descriptive (Mean Scores and Frequency), purposive
3	IJPM, Elsevier	2017	Locatelli, G., Mariani, G., Sainati, T., & Greco, M.	Review study	-	Italy	Case analysis
4	SEE, Springer	2017	Owusu, E. K., Chan, A. P., & Shan, M.	Review study	-	International	Content and thematic analysis.
5	JCEM, ASCE	2017	Chan, A. P., & Owusu, E. K.		-	International	Content and thematic analysis.
6	CME, Taylor and Francis	2007	Bowen, P., Edwards, P., & Cattell, K.	Empirical study	107 out of 193 through a stratified random sampling	South Africa	Frequency with respective percentages and descriptive
7	JCDC	2006	Zou, P. X.	Empirical	14	China	Qualitative analysis, focus-group workshops and face-to-face interviews
8	JME, ASCE	2014	Le, Y., Shan, M., Chan, A. P., & Hu, Y.	Review study	-	International	Document/content analysis.
9	JPIEEP, ASCE	1992	Porter, J. C.	Review study	-	International	Document/content analysis
10	CME, Taylor and Francis	2012	Bowen, P. A., Edwards, P. J., & Cattell, K. (2012)	Empirical study	493 out of 11,608 (Random Sampling)	South African	Qualitative: Thematic analysis
11	JCEM, ASCE	2009	Iyer, K. C., & Sagheer, M. (2009	Empirical Study	4	India	Interpretative Structural Modeling analysis after purposive sampling.
12	LME, ASCE	2009	Stansbury, N. (2009).	Review study	-	The United Kingdom	Review
13	IJMPB, Emerald	2010	Osei-Tutu, E., Badu, E., & Owusu-Manu, D. (2010).	Review Study	-	Ghana	Case with Document/content analysis
14	SEE, Springer	2015	Shan, M., Chan, A. P., Le, Y., & Hu, Y. (2015a)	Empirical Study	188	China	Factor analysis and partial Least squares-structural equation modeling
15	SEE, Springer	2017	Shan, M., Le, Y., Yiu, K. T., Chan, A. P., & Hu, Y. (2017).	Empirical Study	188	China	Factor analysis and partial Least squares-structural equation modeling
16	JCEM, ASCE	2008	Sohail, M., & Cavill, S. (2008).	Review Study	-	International	Reports review Document/content analysis
17	LME, ASCE	2009	Krishnan, C. (2009).	Review Study	-	International	Case reports
18	AA, Wiley	2013	Tidey, S. (2013)	Review Study	-	Indonesia	Document/content analysis
19	JPIEEP, ASCE	2009	Alutu, O. E. (2007).	Empirical study	200 out of 760 (Random Sampling)	Nigeria	Frequency with respective percentages and descriptive

Notes: Full references are found in the referencing list. Abbreviations are listed as follows: JME - Journal of Management in Engineering; ASCE - American Society of Civil Engineers; CME - Construction Engineering and Management; IJPM - International Journal of project management; SEE - Science and engineering ethics; JCEM - Journal of construction engineering and management; JCDC - Journal of construction in Developing Countries; JPIEEP - Journal of Professional Issues in Engineering Education and Practice; LME - Leadership and Management in Engineering; IJMPB - International Journal of Managing Projects in Business; AA - American Anthropologist.

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Table 3: Respondents' Data

No	Categories	Overall		Developed Countries		Developing Countries	
		Number of respondents	Relative Frequency	Number of respondents	Relative Frequency	Number of respondents	Relative Frequency
	SA						
1.1	Public Sector	47	72.3	26	78.8	21	65.6
1.2	Private Sector	10	15.4	2	6.1	8	25.0
1.3	Both	8	12.3	5	15.2	3	9.4
	Total	**65**	**100.0**	**33**	**100.0**	**32**	**100.0**
	PA						
2.1	Engineer	10	15.4	8	24.2	2	6.3
2.2	Quantity Surveyor	12	18.5	2	6.1	10	31.3
2.3	Contractor	2	3.1	1	3.0	1	3.1
2.4	Architect	4	6.2	1	3.0	3	9.4
2.5	Procurement officer	5	7.7	5	15.2	0	0
2.6	Researcher	24	36.9	9	27.3	15	46.9
2.7	Others	8	12.3	7	21.2	1	3.1
	Total	**65**	**100.0**	**33**	**100.0**	**32**	**100.0**
	WE						
3.1	1-5 years	13	20.0	4	12.1	9	28.1
3.2	6-10 years	11	16.9	4	12.1	7	21.9
3.3	11-20 years	18	27.7	8	24.2	10	31.3
3.4	Above 20 years	23	35.4	17	51.5	6	18.8
	Total	**65**	**100.0**	**33**	**100.0**	**32**	**100.0**

Note: SA: Sector Affiliation; PA: Professional Affiliation; WE: Working Experience

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Table 4: Descriptive and Mann-Whitney U Test Statistics of individual barriers

	Overall					Developed Countries				Developing Countries				Mann-Whitney U Test Statistics[a]			
Code	Mean	SD	p-value	Rank	SWT	Mean	SD	Rank	N-value	Mean	SD	Rank	N-value	U Stat*	W*	Z	p-value
BAC1	3.47	1.24	0.001	2	0.000	2.97	1.21	5	0.76 [a]	4.00	1.05	3	0.89[a]	276.500	837.500	-3.394	0.001[a]
BAC2	3.25	1.21	0.000	6	0.000	2.88	1.11	7	0.64 [a]	3.63	1.21	5	0.45	329.000	890.000	-2.755	0.006 [a]
BAC3	3.02	1.38	0.000	13	0.000	2.64	1.39	12*	0.32	3.41	1.26	15	0.19	356.000	917.000	-2.306	0.021 [a]
BAC4	3.02	1.07	0.000	13	0.000	2.58	0.97	16	0.24	3.47	0.98	11	0.26	281.500	842.500	-3.362	0.001 [a]
BAC5	3.11	1.15	0.000	11	0.000	2.64	1.06	12*	0.32	3.59	1.04	6	0.40	285.500	846.500	-3.282	0.001 [a]
BAC6	3.35	1.21	0.000	3	0.000	3.10	1.16	2	0.93 [a]	3.63	1.21	5	0.45	376.500	937.500	-2.106	0.035 [a]
BAC7	3.02	1.17	0.000	13	0.000	2.64	1.19	12*	0.32	3.41	1.01	15	0.19	327.000	888.000	-2.729	0.006 [a]
BAC8	3.20	1.19	0.000	9	0.000	2.94	1.14	6	0.72 [a]	3.47	1.19	11	0.26	398.000	959.000	-1.758	0.079
BAC9	3.06	1.04	0.000	12	0.000	2.70	0.95	10	0.40	3.44	1.01	14	0.23	306.000	867.000	-3.070	0.002 [a]
BAC10	3.25	1.26	0.000	6	0.000	2.67	1.05	11	0.36	3.84	1.19	4	0.70 [a]	225.500	786.500	-4.098	0.000 [a]
BAC11	3.03	1.09	0.000	16	0.000	2.82	1.05	9	0.56 [a]	3.25	1.11	17	0.00	392.000	953.000	-1.875	0.061
BAC12	3.20	1.18	0.000	9	0.000	2.85	1.00	8	0.60 [a]	3.56	1.24	8	0.37	326.500	887.500	-2.726	0.006 [a]
BAC13	3.35	1.39	0.000	3	0.000	2.64	1.17	12*	0.32	4.09	1.20	1	1.00 [a]	202.500	763.500	-4.377	0.000 [a]
BAC14	2.94	1.27	0.000	17	0.000	2.40	0.99	17	0.00	3.50	1.30	9	0.30	266.000	827.000	-3.522	0.000 [a]
BAC15	3.25	1.09	0.000	6	0.000	3.00	0.94	3*	0.80 [a]	3.50	1.19	9	0.30	387.000	948.000	-1.923	0.055
BAC16	3.31	1.09	0.000	5	0.000	3.15	0.94	1	1.00 [a]	3.47	1.22	11	0.26	432.500	993.500	-1.304	0.192
BAC17	3.51	1.12	0.001	1	0.000	3.00	1.00	3*	0.80 [a]	4.03	0.99	2	0.93 [a]	244.500	805.500	-3.850	0.000 [a]

Note: Cronbach's Alpha (for overalls) = 0.926; (for Developed countries) = 0.938; (for Developing countries) = 0.846; Critical Chi-Square value (at p value of 0.05) = 26.30; Actual Chi-Square value (for overalls) = 56.746; (for Developed countries) = 49.850; (for Developing countries) = 44.633; Asymp. Sig. = 0.000 (for overalls; Developed and Developing countries); Df = 16; SWT represents Shapiro-Wilk test; SWT results indicates data were statistically significantly; Normalization (N) value = (actual mean-minimum mean)/(maximum mean-minimum mean); [a] Grouping Variable: Developed and Developing Countries; U Stat*: Mann-Whitney U Test Statistics; W*: Wilcoxon W; MUW at significant; level of 0.05

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Table 5: Degree and Betweenness Centrality of the Barriers

Code	BAC1	BAC2	BAC3	BAC4	BAC5	BAC6	BAC7	BAC8	BAC9	BAC10	BAC11	BAC12	BAC13	BAC14	BAC15	BAC16	BAC17
Dpd/DC	6.608	8.071*	5.419	7.659	7.905	6.654	7.755	7.657	8.168	7.965	7.894*	7.742*	8.544*	2.211	4.367	2.897	4.874
Dpg/DC	0.923	4.308*	2.593	2.315	4.509	2.830	5.123*	3.320	3.247	3.418	3.020	3.490	1.253	2.957	4.632*	4.915*	2.407
Dpd/BC	1.531	7.033#	1.547	1.639	1.964	3.603	5.008	2.033	3.161	5.097	8.647#	12.800#	8.158#	0.100	3.056	0.211	4.411
Dpg/BC	0.000	14.867#	0.000	0.200	4.367	0.575	31.200#	0.775	5.350	6.883	3.233	0.775	0.200	13.842	9.317#	17.417#	1.000

Note: Dpd = Developed countries; Dpg = Developing Countries; BC = Betweenness centrality; DC = Degree centrality; *# top nodes/barriers with a relatively higher degree values of centrality* and betweenness #

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Table 6: Factor Analysis of Barriers in both contexts

Developed Countries				$\bar{x} = \sum xi/n$	Developing Countries					$\bar{x} = \sum xi/n$
Code Variable	SB	PPB	OB		Code Variable	PSB	SB	OB	PB	
Social Barriers (SB)				***2.734***	Psychological barriers (PSB)					***3.507***
BAC5	.846			2.64	BAC12	.861				3.56
BAC10	.843			2.67	BAC6	.835				3.63
BAC4	.828			2.58	BAC8	.803				3.47
BAC7	.794			2.64	BAC11	.783				3.25
BAC6	.721			3.10	BAC2	.741				3.63
BAC11	.671			2.82	BAC14	.569				3.50
BAC9	.580			2.70	Social Barriers (SB)					***3.538***
Psycho-political Barriers (PPB)				***2.845***	BAC10		.832			3.84
BAC13		.818		2.64	BAC3		.773			3.41
BAC3		.760		2.64	BAC5		.713			3.59
BAC1		.713		2.97	BAC7		.697			3.41
BAC17		.694		3.00	BAC9		.550			3.44
BAC2		.665		2.88	Organizational Barriers (OB)					***3.618***
BAC8		.599		2.94	BAC17			.771		4.03
Organizational barriers (OB)				***2.850***	BAC4			.753		3.47
BAC16			.804	3.15	BAC15			.707		3.50
BAC14			.605	2.40	BAC16			.690		3.47
BAC15			.596	3.00	Political Barriers (PB)					***4.045***
BAC12			.568	2.85	BAC13				.698	4.09
					BAC1				.581	4.00
Eigenvalues (EV)	8.807	1.851	1.463		Eigenvalues (EV)	5.230	4.117	1.466	1.054	
Variance (VA)	51.803	10.891	8.608		Variance (VA)	30.762	24.217	8.626	6.200	
Cumulative Variance (CV%)	51.803	62.694	71.302		CV%	30.762	54.979	63.605	69.805	
N-values	0.000	0.957	1.000		N-values	0.000	0.0576	0.206	1.000	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.				0.765	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.					0.568
Bartlett's Test of Sphericity Approx. Chi-Square				462.495	Bartlett's Test of Sphericity Approx. Chi-Square					341.126
df				136	df					136
Sig.				0.000	Sig.					0.000

$\bar{x} = \sum xi/n \ldots equation$ (1); where $\bar{x}$ represents the mean, $\sum xi$ is the summation of sampled values or frequency; n represents number of respondents or items.

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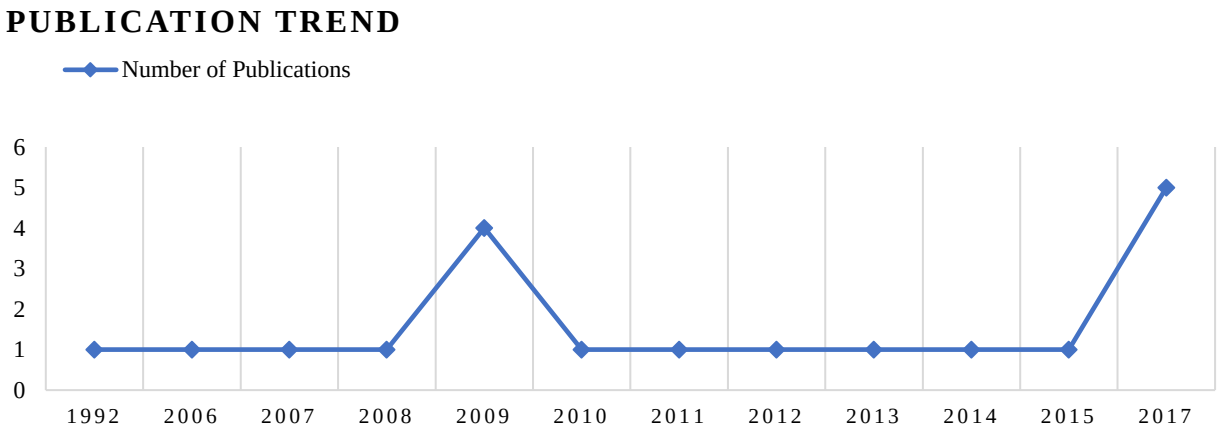

Figure 1: Publication trend of selected papers

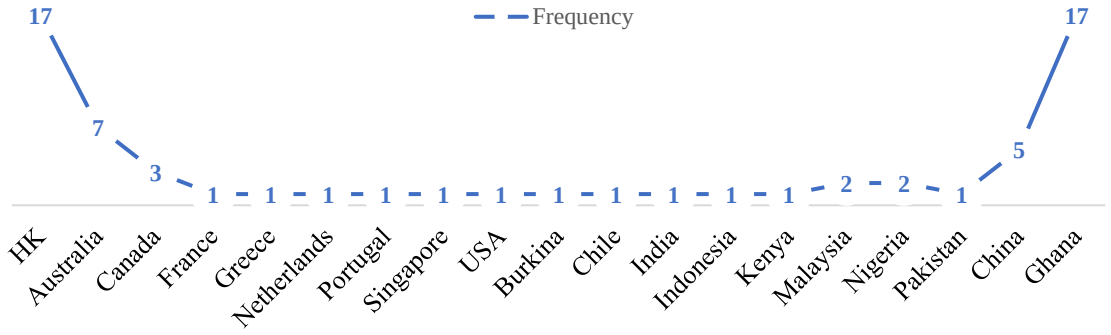

Figure 2: Respondents Countries

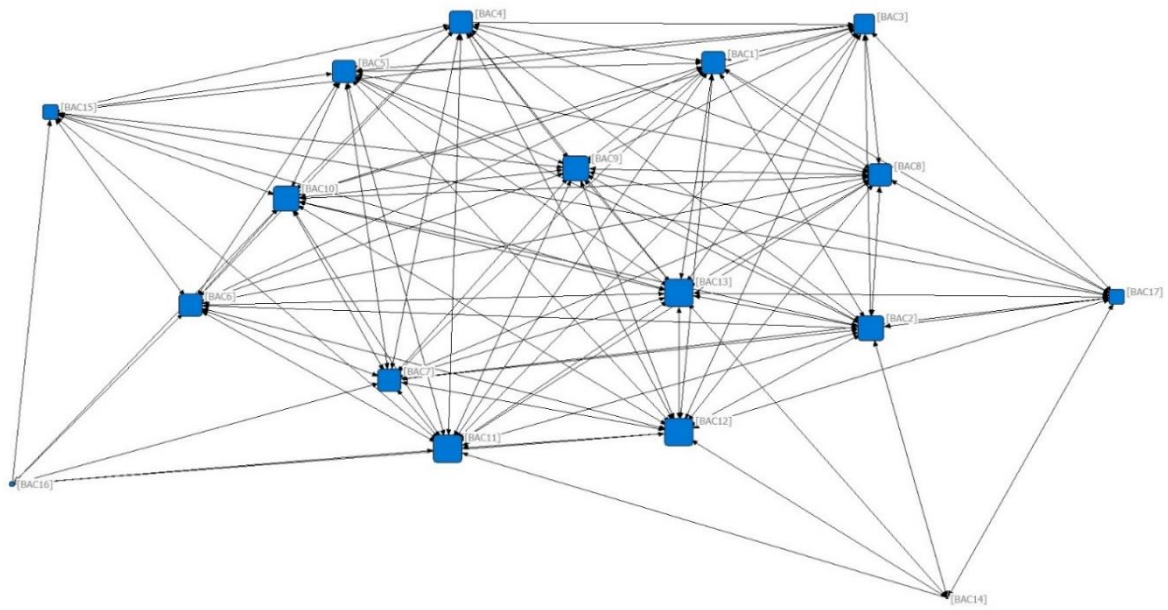

Figure 3: Network Analysis, highlighting the degree of relationships (centrality and betweenness) for the ACMs barriers in the developed context.

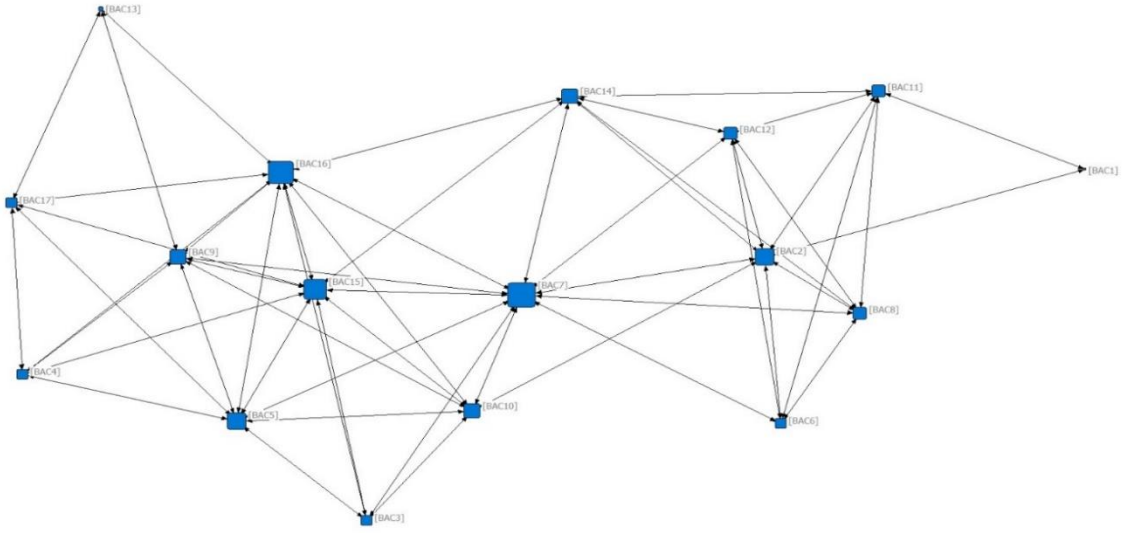

Figure 4: Network Analysis, highlighting the degree of relationships (centrality and betweenness) for the ACMs barriers in the developing context.

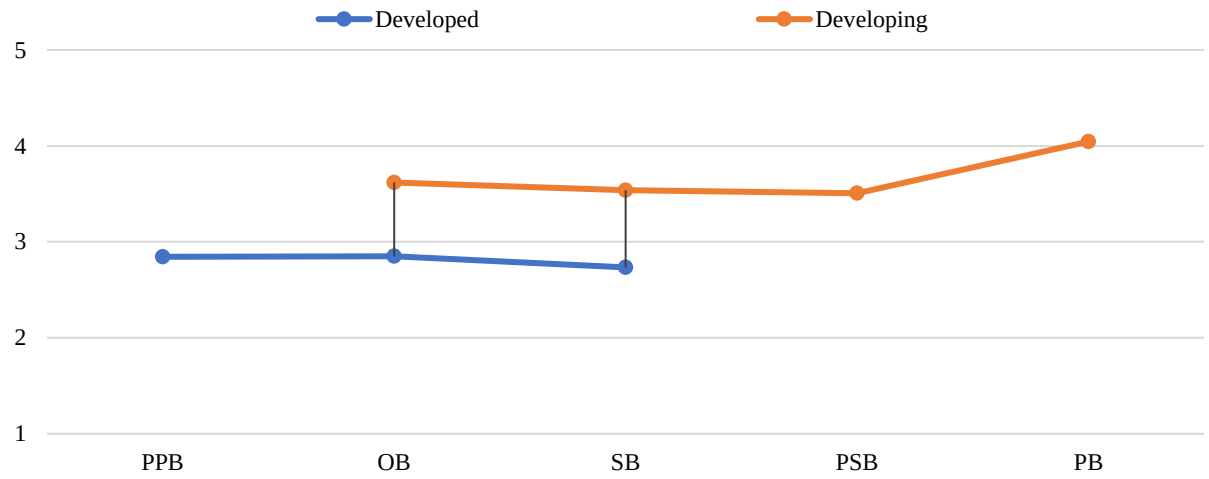

Figure 5: Constructs' Comparison of the two contexts (i.e. developed and developing countries)