SOCIAL SUSTAINABILITY IN DELIVERY AND PROCUREMENT OF PUBLIC CONSTRUCTION CONTRACTS

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ABSTRACT

Boosting sustainability in public construction procurement implies new challenges associated with incentivizing integrated approaches and inclusion of sustainability criteria in tendering procedures. Thus, the choice of project delivery method and procurement procedure is a key decision to ensure project success for sustainable outcomes. This study focuses on the social dimension of sustainability and analyzes 451 tendering documents from 10 countries to assess the influence of procurement procedures and delivery methods on the inclusion of social criteria in public construction procurement. Content analysis, descriptive statistics, and logistic regression are applied. The results show the international trends in delivery methods and procurement procedures. Country and contract size are the most influential variables for inclusion of social criteria in tendering procedures. There are no significant differences between project delivery methods and between procurement procedures respect to the inclusion of social criteria. However, criteria associated with employment and cultural heritage are mainly considered in traditional delivery methods, whereas professional ethics and cultural heritage are associated with lowest-price procurement procedures. Finally, subjective methods are predominantly used to assess social sustainability.

KEYWORDS: social; sustainability; procurement procedure; delivery method; construction

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INTRODUCTION

Public procurement represents a large volume of public spending each year, constituting over 10% of the gross domestic product in developed countries (Zhu et al. 2013). Thus, numerous studies have highlighted the main role of public procurement in influencing the market in terms of sustainability (Barber and El-adawa 2015; Hosseini et al. 2018; Mont and Leire 2000),with sustainability framed within a three-dimensional framework that involves three levels, economic, social and environmental (Kornevs et al. 2014). During the last decades, a great number of countries worldwide have implemented policies to encourage the development of social principles in public procurement (Iles and Ryall 2016), encompassing the public procurement of the construction industry (Green 2014). However, in this industry, there is still much that needs to be done (Roman 2017). In terms of social practices, the construction industry is one of the most lagging industries (Loosemore 2015) and needs to be transformed to address increasing social challenges (Whyte and Sexton 2011).

Social requirements in construction procurement potentially affect processes and management systems and have important implications for both procuring organizations and suppliers (Sutherland et al. 2015). Hence, with the thrust of social sustainability in public construction procurement, new challenges have emerged. Barraket and Weissman (2009) stated that advances in social procurement of the construction industry must be located within a relational approach to procurement. This relational approach represents a change from the traditional procurement towards new alternative methods of procurement procedures (Petersen and Kadefors 2016) and project delivery methods (Sporrong and Kadefors 2014).

Within public construction procurement, the two basic procurement procedures are the lowest price and the best value (Molenaar and Johnson 2003). In general, the lowest price is used when aiming to maximize savings, whereas the best value is used more for complex projects (Ballesteros-Pérez et al. 2017). However, historically, contracting authorities of construction services have selected the lowest price rather than the best value regardless of the complexity of the project (Korytárová et al. 2015). Currently, with the implementation of sustainability in public construction procurement, the formulation of environmental and social criteria in the tendering procedure is imperative to reflect clients' needs and project objectives (Palmujoki et al. 2010). The best-value procurement procedure gives scope to public bodies to consider social policy objectives in their procurement activities (Brammer and Walker 2011).

Regarding project delivery methods, different approaches have been developed during the last years to satisfy specific requirements related to risk transfer, funding, and ownership (Broesterhuizen et al. 2014) or to encourage integration and collaboration among diverse organizations involved in delivering construction projects (Koolwijk et al. 2018). Several researchers have suggested that sustainable construction projects require a higher level of stakeholder engagement and collaboration to generate more intensive cooperative behavior (Ball and Fortune 2000; Berry et al. 2011; Broesterhuizen et al. 2014; Hanák and Muchová 2015; Naoum and Egbu 2016; Olanipekun et al. 2018; Wu et al. 2017). Authors such as Molenaar et al. (2009), Korkmaz et al. (2011), Naoum and Egbu (2016) and Manata et al. (2018) have pointed out team integration as a key factor for project success. The concept of team integration is based on the involvement of all the participants in the project at the correct time (Drexler and Larson 2000), and it is defined by aspects such as the timing of the involvement of project participants, early collaboration by the project participants, or the timing of communication (Mollaoglu-Korkmaz et al. 2013).

Based on team integration, according to Pellicer et al. (2016) and Naoum and Egbu (2016), the research team established two groups of delivery methods: traditional and integrated. In traditional, or design-bid-build (DBB), team integration is scarce because design and construction are undertaken by different entities (Pellicer et al. 2016). Integrated approaches include design-build (DB), integrated project delivery (IPD), and public-private partnerships (PPP) and other concessionaire alternatives. The client generally provides initial planning and design criteria, and the contractor team is completely or partially responsible for design, construction, operation, and maintenance of the facility (Altamirano 2010; Broesterhuizen et al. 2014; Gurgun and Touran 2014; Molenaar et al. 2009). Partially integrated delivery systems, such as Construction Management at

Risk (CMR), where the constructor is involved in the design, and variants of DB, IPD, and PPP are also considered Integrated (Mollaoglu-Korkmaz et al. 2013; Pellicer et al. 2016).

Thus, providing motivation to the contractor and improving efficiency of communication between the design team and the constructor are characteristics of integrated project delivery methods that foster a better chance in achieving sustainability goals than traditional methods (Molenaar et al. 2009). Consequently, moving from traditional procurement procedures and delivery methods becomes a key factor for the sustainability of the construction industry (Ruparathna and Hewage 2015a; Xia et al. 2015) to ensure the achievement of sustainable outcomes (Naoum and Egbu 2016).

KNOWLEDGE GAP AND GOALS OF THE RESEARCH

Most of the literature published on construction procurement has focused on the basis of evaluation, analyzing the relationship with different types of procurement procedures or project delivery methods (Ruparathna and Hewage 2015a; Sourani and Sohail 2011; El Wardani et al. 2006; Xia et al. 2013). In terms of sustainability on public construction procurement, considering the three dimensions (economic, environmental, and social), the majority of research has been conducted on economic and environmental issues, overshadowing the social dimension (Illankoon et al. 2016). In fact, Loosemore (2016) stated that, although during the last 50 years there has been considerable research in construction procurement, the study of social procurement has barely been addressed. Social and economic objectives associated with sustainable procurement have only received attention more recently (Walker and Phillips 2009). Thus, there is clearly a need for the study of the social dimension of sustainability and its inclusion in public construction procurement, analyzing the aspects that demonstrate a significant influence on its implementation at the international level.

Therefore, the aim of this paper is to assess the influence of procurement procedures and project delivery methods on the inclusion of social criteria in public construction procurement. For that end, an introductory analysis is conducted to show how procurement procedures (lowest price and best value) and project delivery methods (traditional and integrated) are considered at the international level (G1). Subsequently, the use of social criteria at each stage of the tendering procedure is analyzed, considering the existing differences between procurement procedures (G2). Finally, a global analysis is conducted to identify which variables associated with project characteristics are the most influential in introducing social criteria in public construction procurement (G3). The achievement of these goals can be of great interest to procurers and companies, showing them a comparative view of a small sample of the current situation in social sustainability terms in the public construction industry at the international level.

RESEARCH METHOD

To achieve the goals stated in the previous section, the authors followed the overall research method summarized in Fig. 1. The first step was to develop a content analysis of tendering documents related to construction products and services, published in English or Spanish, aiming to determine the inclusion of social criteria in public construction procurement. With the final sample, two logistic regressions were performed to determine how procurement procedures and project delivery methods are related to the project contract size, project infrastructure, and country where tendered. Later, descriptive statistics were used to find the use of social criteria at each stage of the tendering procedure. Lastly, a logistic regression determines the variables that influence the introduction of social criteria in public construction procurement. These steps are explained in-depth in the following paragraphs.

Content analysis of tender documents was the method developed to gather data in this research. Content analysis is a research technique that allows to make replicable and valid inferences from data to their context (Krippendorff 1989). This is a systematic technique that is based on an objective analysis. It allows analyzing large volumes of written material through frequencies, meanings, and relationships of the data (Krippendorff 1989; Neuendorf 2017). According to the recommendations of Neuendorf (2017) and Stanford et al. (2016), content analysis was based on five tasks: defining the protocol, collecting tender documents, examining documents according to the protocol, establishing inter-rater reliability, and statistically analyzing the data.

The protocol to guide content analysis was developed based on the recommendations of Stanford et al. (2016) and Neuendorf (2017). The aim of the protocol was to establish the coding procedure, variables of interest, recommended search terms, and examples of expected typical results. Thus, a literature review was undertaken to identify the characteristics of tendering documents and the different groups of social criteria to be analyzed throughout the protocol (Table 1). On one hand, the variables associated with project characteristics were: (1) infrastructure type, discriminating between buildings and civil engineering projects; (2) contract size, represented by the initial budget of the project; (3) procurement procedure, based on the lowest price and best value; (4) project delivery method, discerning between traditional and integrated; and (5) country, which was classified based on Anglo-Saxon countries (ASCs) and Spanish-speaking countries (SSCs). On the other hand, seven groups of social criteria were identified (Table 1): (a) cultural heritage, which considers criteria associated with the preservation of historic and cultural resources and the consideration of professional expertise in cultural heritage in the project; (b) employment, which gathers criteria such as job creation, employment to vulnerable groups, job stability and industry participation planning; (c) health and safety, regarding workplace health and safety management planning, occupation health and safety certifications, professional expertise in health and safety, or ensuring public safety; (d) training, which is focused on improving the workforce skills in technical and sustainability terms; (e) effects on users, with respect to avoiding or minimizing the harm done to the neighborhood, and existing services, and mobility disruption; (f) local, boosting local development through criteria such as local preferences, local participation or improving social value; and (g) professional ethics, which encompasses ethical aspects in the development of work and staff recruitment, such as non-discriminatory hiring practices, commitment to anti-corruption, gender equality, or fair wages. Once the variables were identified, the protocol was defined, and the scope of this research was established.

To identify the materials to be analyzed, websites of contracting authorities and national databases in each country were searched to gather tendering documents related to construction products and services. The search was conducted from January 2016 to January 2017, and only those tendering documents which were published in English or Spanish and were available free online were selected. Initially, 534 tendering documents from 13 countries were obtained; however, those tendering documents that did not include tender characteristics, technical specifications of the project, and contract performance clauses were removed from the sample. Finally, 451 tender documents were selected from 10 countries, as displayed in Table 2: four ASCs, Australia, Canada, the UK, and the USA, and six SSCs, Argentina, Chile, Colombia, Panama, Peru, and Spain. One-third (33%) of the tendering documents did not contain information about the budget in the award phase. These tenders correspond mainly to Australia, Canada, and the UK. Regarding the types of civil engineering projects gathered in the sample, 53% are road and highway projects, and 22% are projects for hydraulic work, while the rest of the tenders are railways, airports, and maritime projects.

Once the tendering documents were gathered, these were analyzed according to the protocol. To ensure the objectivity of the analysis and guarantee the correct implementation of the content analysis, inter-rater reliability for each variable was measured. Following the recommendations of Stanford et al. (2016), two coders examined one tendering document randomly selected from each country to refine the coding process and ensure consistency. Then, 50 tendering documents, more than 10% of the total of gathered documents (Cohen 1960), were randomly selected for independent coding to measure inter-rater reliability. The percentage of agreement between raters (PAo) was calculated for the continuous variable (contract size), and Cohen's kappa (Cohen 1960) was selected to calculate the inter-rater reliability of the discrete variables (the rest of the analyzed variables). According to Stanford et al. (2016) and Neuendorf (2017), PAo is a measure that is widely used and easily understood for determining inter-rater agreement. The observed proportion of agreement is simply calculated as the number of agreements between raters divided by the total number of units coded by both raters. Cohen's kappa is an indicator of agreement that has been widely used internationally due to the additional benefit of accounting for chance agreements among raters selected between pre-defined categories (Neuendorf 2017). Cohen's kappa is calculated as follows:

$$\kappa = (PA_o - PA_g) / (1-PA_g),$$

where PA_o is the proportion agreement observed, and PA_g is the proportion of agreement expected by chance (for additional details on the calculation of PA_g, see Cohen, 1960). Both measures, PA_o and κ, range from 0.0 to 1.0, with a 1.0 indicating perfect agreement (Stanford et al. 2016). Values equal to or greater than 0.80 are often considered satisfactory (Neuendorf 2017). In this research, inter-rater reliability proved satisfactory by achieving values greater than or equal to 0.8 for every variable.

After assessing the inter-rater reliability of the sample, statistical analyses were undertaken using IBM SPSS Statistics 23.0. To answer how procurement procedures and project delivery methods are considered at the international level (G1), a logistic regression analysis was performed. Logistic regression analysis is a technique that is generally used to predict the probability of failure (or success) of a given process, system, product, or phenomenon (Aznar et al. 2017). However, this technique is also widely used to identify those variables (predictors) that demonstrate a strong relationship with the dependent variable subject of study (Aznar et al. 2017). Two logistic regressions were conducted to determine which procurement procedure (0: lowest price or 1: best value) and which project delivery method (0: traditional or 1: integrated) are used considering the project contract size, project infrastructure, and country of origin. For statistical analysis, the groups of contract size 1 M€-10 M€ and those with an unspecified budget were grouped after verifying that both did not show significant differences. The analysis of the logistic regression results was based on the following: coefficients of the independent variables (B) allow predicting the probability of occurrence of a dichotomous dependent variable, whereas the Wald statistic assesses the significance of the best coefficient values (B) found for the logistic regression model. This corresponds to the ratio between the square of B and square of the standard error and is asymptotically distributed as a chi-square distribution (Aznar et al. 2017). The odds ratio (Exp(B)) is an indicator of the change in odds resulting from a unit change in the predictor (Field 2013).

To assess the use of social criteria in each stage of the tendering procedure considering significant differences between procurement procedures (G2), first, three phases were defined within a tendering procedure: “selection criteria” (SC), which includes information about selection and exclusion provisions and solvency conditions; “award criteria” (AC), which gathers the criteria that are considered to select the best bid; “technical specifications and contract performance clauses” (TS&CPC), which are detailed prescriptions of the characteristics that the product or service must accomplish to be accepted and the execution clauses with which the awarded company contract must comply.

Second, to assess how social criteria are included, two terms were differentiated based on the indicator and the metric (Winter and Lasch 2016). Social indicators represent those requirements that are defined to evaluate and motivate progress towards specific objectives. Metrics are those indicators whose definition includes quantitative measurement. Once the authors prepared the data, descriptive statistics were developed based on the frequencies of occurrence of each group of social criteria in tendering documents, considering each criterion if it appears at least once in the tendering document. To analyze whether there are significant differences between procurement procedures with respect to the mean of social criteria, the Mann-Whitney U-test was performed, This is a non-parametric statistical procedure for comparing two samples that are independent (Loosemore and Denny-Smith 2016; Xia et al. 2014a).

Finally, a global analysis was developed to identify which variables are the most influential in introducing social criteria in public construction procurement (G3). To meet this research goal, for each group of social criteria one logistic regression was conducted with the dependent variable as each of the social criteria and the independent variables as the rest of the analyzed variables (procurement procedure, project delivery method, contract size, type of infrastructure, and country).

The Wald statistic was calculated to inform the individual contribution of those predictors that showed significant differences (Field 2013).

RESULTS AND DISCUSSION

Current trends in the use of project delivery methods and procurement procedures

The success of a project is significantly influenced by the criteria that are established to evaluate the bids. In fact, numerous investigations (Bruno et al. 2018; Doloi 2013; Hanák and Muchová 2015; Palmujoki et al. 2010; Ruparathna and Hewage 2015a; Wang et al. 2006; Witjes and Lozano 2016) highlight the important problem associated with the use of the lowest price as the sole evaluation criterion to reach sustainability goals. This is because including suitable criteria is key to ensuring the technical, economical and professional capability of the contractor and to illustrate the needs of clients and project goals. Thus, during last decades, construction procurement has experienced a transformation from lowest-price to best-value procurement (Okunlola 2012). This fact can be seen in Table 2, where the best-value procurement is considered in 61% of the analyzed sample; and in Fig. 2, which shows that more than 50% of traditional delivery methods include best-value procurement procedures. These percentages are highly influenced by the results associated with ASC, since these countries show a clear predisposition towards the use of best-value in both traditional and integrated delivery methods.

Nevertheless, although the transformation towards best-value procurement is a fundamental feature to include social sustainability criteria in the awarding of a project, Broesterhuizen et al. (2014) remarked that, in the procurement phase of a construction project, not only setting sustainable criteria is important, but the choice of an integrated delivery method can be decisive to facilitate project sustainability. Numerous researchers (Oyegoke et al. 2009; Pellicer et al. 2016; Ruparathna and Hewage 2015a; Shrestha et al. 2012; Stanford et al. 2016; Xia et al. 2014a) have highlighted that, during recent years, projects have been evolving towards integrated approaches. However, the data gathered in Table 2 show that only 20% of the sample comprises integrated delivery contracts. This fact concurs with the findings by authors such as Naoum and Egbu (2016), who emphasized that the traditional form is still the dominating procurement method.

To assess the use of project delivery methods and procurement procedures within the gathered sample, two logistic regressions were developed. First, the interaction between the project delivery method (the dependent variable with two possible outcomes: 0 = traditional or 1 = integrated) and the independent variables (contract size, infrastructure, and country) was investigated. Table 3 results show that the three independent variables were statistically significant (p-value < 0.05). According to the Wald statistic of each independent variable, the project contract size is the most influential variable with respect to the decision of using integrated project delivery methods, followed by the type of infrastructure. Based on the odds ratio (Exp(B)), building projects tend to be procured through integrated project delivery methods; however, civil engineering projects are more oriented towards traditional methods.

Furthermore, ASCs show a greater use of integrated methods in comparison with SSCs. The use of integrated delivery methods increases considerably in projects whose contract size is over 10 M€. Oyegoke et al. (2009) stated that the use of integrated delivery methods, such as DB, has increased for projects with important contract value due to the needs of achieving significant change in project organization, structure, and communication channels. However, the countries that have primarily boosted these types of delivery methods are the USA (Hale et al. 2009) and the UK (Barraket and Weissman 2009), especially in building projects. In fact, Xia et al. (2014) pointed out that 75% of the current new building construction projects seeking sustainability certification in the USA were delivered with integrated project delivery methods.

Regarding procurement procedures, the logistic regression considered the dependent variable to be 0 = the lowest price or 1 = the best value, whereas the independent variables were infrastructure, project delivery method, contract size, and country. According to the results (Table 4), the four independent variables were statistically significant. Best value prevails in integrated delivery methods, where the odds ratio is 3.5 times higher with respect to traditional methods. The use of best value is notably higher in ASCs compared to SSCs, where the odds ratio is 2.3 times higher. Furthermore, the greater the contract size, the higher the odds of using the best value. Additionally, the Wald statistics highlight that contract size is the most influential variable, followed on a similar level by the project delivery method and country. These findings are consistent with the literature because authors such as Molenaar et al. (2010) and Xia et al. (2015) have highlighted that integrated delivery methods tend to utilize best-value procurement to provide opportunities for the contractor to pursue sustainability objectives as well as those concerning time, cost, and quality. Moreover, Doloi (2013) remarked that the traditional method generally selects the lowest price to reduce the costs associated with the project. However, civil engineering projects are oriented towards the use of the lowest price due to the many uncertainties in the pre-construction stage (Varnäs 2008) and the difficulty to define objective criteria (Ruparathna and Hewage 2015a). Thus, the results obtained in both logistic regressions confirm the robustness of the analyzed sample for drawing conclusions.

Inclusion of social criteria depending on procurement procedures

The following step was to assess how social criteria are included in tendering documents depending on the procurement procedure. As it can be seen in Fig. 3, the main differences between both procurement procedures lie in the AC phase. Predictably, the percentage of social criteria in the AC phase of lowest price procurement procedures is 0; however, best value considers social criteria as award criteria in 55% of their tenders. This percentage is low if it is compared with that found by (Testa et al. 2016), who stated that, regarding tenders based on best value, environmental criteria were included as award criteria in 87% of their sample. On the other hand, the mean number of social criteria included in this phase of best-value procurement tenders is 1.5 (Table 5). This value is slightly lower than the one found by Ruparathna and Hewage (2015b) who disclosed that the mean number of social criteria included in their analyzed tendering documents was 2.04. Additionally, it is worth pointing out that only 3% of the tenders based on best-value procurement use metrics to assess social criteria in the AC phase. This result is in line with the findings by Park et al. (2015), who remarked on the lack of appropriate evaluation procedures that avoid the subjectivity of best-value criteria and ensure transparency, objectivity, and equitability of bid selection processes. Consequently, these results highlight the low consideration of social criteria as AC and the lack of objective methods for bid evaluation, depicting two of the main challenges for sustainable procurement.

Regarding the inclusion of social criteria in SC and TS&CPC phases, Fig. 3 reveals that there are no strong differences between procurement procedures respect to the percentage of tenders that considers any social criteria (SC phase: 42.8% for lowest price, 49.3% for best-value; TS&CPC: 96.0% for lowest price, 96.4% for best-value). To analyze whether there are significant differences between procurement procedures with respect to the mean of social criteria included in the SC and TS&CPC phases, the Mann-Whitney U-test is conducted. The results in Table 5 show that only the SC phase has statistically different means (p-value < 0.05), revealing that lowest price procurement procedures tend to include a greater number of social criteria in the SC phase in comparison with best-value procedures. However, the mean of social criteria for both procurement procedures is similar in the TS&CPC phase (p-value > 0.05). Additionally, the global analysis of tenders shows that, regarding the mean of social criteria per tender, there is no significant difference between the lowest price and best-value procurements procedures, as the mean of social criteria per tender is approximately 3 for both procurement procedures (Table 5).

Thus, it can be emphasized that, even using lowest-price procurement, contractors are forced to reduce the initial bid price (Lo and Yan 2009) and the inclusion of performance indicators is key to ensure compliance of clients' needs and social sustainable objectives (Bruno et al. 2018). Tenders based on lowest-price procurement only compensate for the lack of inclusion of social criteria in the AC phase with an increase of these criteria in the SC phase.

Regarding the use of the different groups of social criteria in each phase of the tendering procedure: a) health and safety, and employment are the most considered social criteria in the SC phase for both lowest price (30% and 25%, respectively) and best-value (29% and 22%, respectively) procurement procedures, followed by local criteria (9% in lowest price and 12% in best-value); b) in the AC phase, the most frequently used criteria in tenders based on the best-value procurement are health and safety (31%), local (21%), employment (15%), and training (10%); and (c) in the TS&CPC phase, every group of social criteria is similarly included in both procurement procedures. However, professional ethics criteria are considered more in the lowest-price projects (46%) than in the best-value projects (24%), and local is included in 24% of the best-value tenders and 13% of the lowest-price tenders. Finally, the global analysis on tendering documents shows that health and safety, professional ethics and employment are the social criteria most frequently used in the lowest price procurement procedure, while health and safety, employment and effects on users are the social criteria most commonly included in the best-value procurement procedure.

Influential variables in the inclusion of social criteria

To identify the most influential variables in the inclusion of social criteria into public construction procurement, a logistic regression was developed for each group of social criteria. For each logistic regression, the dependent variable was the social criteria, categorized as 0 (not inclusion) and 1 (inclusion), and the independent variables were project delivery method, procurement procedure, infrastructure, country, and contract size. Table 6 gathers only the results associated with those independent variables that were significant (p-value < 0.05). Health and safety was not included because this criterion is used in practically all the tendering documents, and the differences with respect to each independent variable were not significant.

Table 6 shows that, regarding the inclusion of social criteria in public construction procurement, based on the results of the Wald statistics, the most influential variables are country and contract size. The insertion of cultural heritage, employment, and professional ethics in tendering documents is notably influenced by the contract size. Alternatively, training, effect on users, and locality depend mainly on the country. As Kahlenborn et al. (2010) asserted, national policies are the main drivers to integrate social sustainability in public procurement, and the inclusion of social performance indicators in tendering procedures increases with the contract size and with the complexity of the project.

Cultural heritage and employment are strongly influenced by contract size and country. Their odds ratio shows that the use of both increase significantly with the contract size, and these are more common in ASCs. However, employment is also influenced by the project delivery method, which is more frequent in the traditional method. Regarding professional ethics, in addition to the contract size, this criterion is also influenced by the procurement procedure, as it is more commonly used in the lowest-price projects and in ASCs. Furthermore, training, effect on users, and local criteria are especially considered in ASCs; however, effect on users is strongly influenced by the type of infrastructure because it tends to be considered more in civil engineering projects.

Regarding the inclusion of social criteria in tendering documents the results show that there are generally no significant differences between project delivery methods and between procurement procedures. Only employment and cultural heritage are more frequently included in traditional delivery methods. Additionally, criteria associated with professional ethics and cultural heritage are important in lowest-price procurement procedures to ensure that the cost-cutting tactics that characterize this type of project (Lines and Miao 2016) do not end up affecting social heritage and malpractice.

CONCLUSIONS

Contributions

By assessing 451 tendering documents from 10 countries, this research analyzes the influence of project delivery methods and procurement procedures on the insertion of social criteria in public construction procurement. The research method is based on content analysis, descriptive statistics, and logistic regression techniques. To consider the robustness of the sample, the use of project delivery methods and procurement procedures is assessed. Results confirm what is widely highlighted by numerous researchers. The best-value procurement procedure is achieving strength, especially in integrated delivery methods where it is prevailing.

However, the use of the traditional delivery method is still dominant, and, practically, this type of delivery method uses the lowest price as the main procurement procedure. On the other hand, the choice of the project delivery method and procurement procedure is highly influenced by the variable contract size, because the use of integrated delivery methods and best-value procurement procedures increases considerably with the project contract size.

Additionally, significant differences exist between types of infrastructure and countries regarding the use of project delivery methods. Building projects are more focused on integrated delivery methods than civil engineering projects, which tend to use the traditional method. The SSCs are still closely focused on traditional methods, forgetting that the need for bolstering sustainability in public construction procurement departs from enhancing the use of best-value procurement procedures and integrated delivery methods.

Regarding the inclusion of social criteria in the analyzed tendering documents, the descriptive statistics showed that there are hardly any differences between both procurement procedures. The lack of social criteria in the AC phase of the lowest-price tenders is only compensated by increasing social criteria in the SC phase. However, only 50% of tenders with best-value procurement procedures consider social criteria in the AC phase, and there is an absence of metrics to assess social criteria encouraging subjective assessments.

In terms of determining the most influential variables including social criteria in public construction procurement, the logistic regressions showed that these variables are country and contract size. Because ASCs are clearly ahead of SSCs regarding the consideration of social criteria and procurers generally appear to be more aware of social sustainability as the contract size increases. Finally, it is worth emphasizing that there are no significant differences between project delivery methods and between procurement procedures with respect to the inclusion of social criteria. However, there is a visible trend towards the use of employment and cultural heritage in traditional delivery methods and the use of professional ethics and cultural heritage in lowest-price procurement procedures.

Recommendations

The study of social sustainability in public construction procurement is required to know how to overcome the current barriers that are affecting successful implementation. Major efforts should be made to integrate social sustainability appropriately within contractual procedures. In fact, although the use of social criteria in tendering procedures is a reality, in general, less than three groups of social criteria are included per tender. Instead of being defined according to the particular needs of the environment where the projects will be developed, these are mainly established based on national policies that are implemented in each country. Additionally, the use of subjective methods to assess social criteria in tendering procedures is the predominant option. Thus, working on these weaknesses and increasing social awareness in the construction industry is needed. For that purpose, providing a mutual understanding of social policies and explaining how these can be adjusted for each specific project and how these can be implemented depending on procurement procedures and project delivery methods would be useful for procurers to reduce their uncertainty of how to incorporate social sustainable issues in tendering procedures. The inclusion of performance indicators in construction procurement, regardless of the project delivery method or procurement procedure, is required to ensure that procurer's objectives are achieved. Increasing the number of social criteria in the tendering documents and including metrics to allow an objective assessment of social sustainability in tendering procedures are key measures to boost the social sustainability effectively. These recommendations are especially important in integrated projects, where aspects such as the early collaboration of the project's participants or the timing of communication are most likely to achieve sustainable outcomes. They are also key in projects with best-value procurement procedures in which the social criteria can be a fundamental part of the AC in the tendering procedures. Hence, tools, guides, and training programs are needed to drive procurers effectively towards the inclusion of social criteria.

Limitations

The data collection was based only on those documents that were available free online on the public procurement Internet websites of each country. Tendering documents are mainly from national or regional agencies, which notably reduced the number of documents from local authorities. Although the searches of the government procurement sites were largely consistent, it is possible that some tendering documents were mischaracterized, excluding them from the search results. Thus, this study cannot claim a truly random sample. However, these limitations are also shared by other studies based on the content analyses of tendering documents. Furthermore, the sample distribution (i.e. contract size) for groups of countries is not balanced; despite considering the contract size as an independent variable in the statistical analysis, the results related to contract value may be skewed.

Future lines of research

Future research is needed to assess the social effects that the choice of project delivery methods and/or procurement procedures has in construction projects, depending on contract size, country, and type of infrastructure. Additionally, the analysis of weights of the criteria that are considered in the AC phase would be useful to understand the level of importance that each country assigns to social and environmental sustainability. Finally, establishing an automatic process that enables defining the weights of sustainability of AC depending on the environmental demands of each specific project would be extremely useful.

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REFERENCES

Altamirano, M. (2010). "Innovative contracting practices in the road sector: Cross-national lessons in dealing with opportunistic behaviour." Delft University of Technology.

Amiril, A., Nawawi, A. H., Takim, R., and Latif, S. N. F. A. (2014). "Transportation Infrastructure Project Sustainability Factors and Performance." *Procedia - Social and Behavioral Sciences*, Elsevier B.V., 153, 90–98.

Azapagic, A., and Perdan, S. (2000). "Indicators of Sustainable Development for Industry: A General Framework." *Institution of Chemical Engineers. Trans IChemE*, 78(B4), 243–261.

Aznar, B., Pellicer, E., Davis, S., and Ballesteros-Pérez, P. (2017). "Factors affecting contractor's bidding success for international infrastructure projects in Australia." *Journal of Civil Engineering and Management*, 23(7), 880–889.

Ball, D., and Fortune, C. (2000). "Building project procurement processes and the development of environmentally friendly housing schemes." *In: Akintoye,Akintoye, A (Ed.), 16th Annual ARCOM Conference, 6- 8 September 2000, Glasgow Caledonian University. Association of Researchers in Construction Management*, 1, 271–279.

Ballesteros-Pérez, P., Pellicer, E., and González-Cruz, M. C. (2017). "MULTI-ATTRIBUTE CONSTRUCTION AUCTIONS." *Proceedings of the Ninth International Structural Engineering and Construction Conference Valencia, Spain, July 24-July 29, 2017*, 1–6.

Balubaid, S., Bujang, M., Nur Aifa, W., Kian Seng, F., Raja Muhammad Rooshdi, R. R., Hamzah, N., Mohd Yazid, Y. S., Abd. Majid, M. Z., Mohamad Zin, R., Zakaria, R., Hainin, M. R., Yaacob, H., and Ismail, H. H. (2015). "Assessment Index Tool for Green Highway in Malaysia." *Jurnal Teknologi*, 77(16), 99–104.

Barber, H. M., and El-adawa, I. H. (2015). "Economic Performance Assessment for the Construction

Industry in the Southeastern United States." *Journal of Management in Engineering*, 31(2), 05014014-.

Barraket, J., and Weissman, J. (2009). *Social procurement and its implications for social enterprise : a literature review [Working Paper No. CPNS48]. The Australian Centre for Philanthropy and Nonprofit Studies, Brisbane.*

Berry, C., Mccarthy, S., Berry, C., and Mccarthy, S. (2011). *Guide to sustainable procurement in construction. CIRIA report, CIRIA, London.*

Brammer, S., and Walker, H. (2011). "Sustainable procurement in the public sector : an international comparative study." *International Journal of Operations & Production Management*, 31(4), 452–476.

Broesterhuizen, E., Vellinga, T., Taneja, P., and van Leeuwen, L. D. (2014). "Sustainable Procurement for Port Infrastructure Projects." *Topics in Safety, Risk, Reliability and Quality*, 24, 11–26.

Bruno, T., Gelderman, C. J., Lambrechts, W., and Semeijn, J. (2018). "The promise of Best Value Procurement: Governance and (in)stability of specifications within an innovative biogas project." *Journal of Cleaner Production*, Elsevier Ltd, 172, 1465–1475.

Cohen, J. (1960). "A Coefficient of Agreement for Nominal Scales." *Educational and Psychological Measurement*, 20(1), 37–46.

Dobrovolskiien, N., and Tamošiluniene, R. (2016). "An Index to Measure Sustainability of a Business Project in the Construction Industry : Lithuanian Case." *Sustainability*, 8(14), 1–14.

Doloi, H. (2013). "Empirical Analysis of Traditional Contracting and Relationship Agreements for Procuring Partners in Construction Projects." *Journal of Management in Engineering*, 29(3), 224–235.

Drexler, J. A., and Larson, E. W. (2000). "Partnering: Why project owner-contractor relationships change." *Journal of Construction Engineering and Management*, 126(4), 293–297.

Fatokun, A., Akintoye, A., and Liyanage, C. (2015). "Renegotiation of Public Private Partnership Road Contracts: Issues and Outcomes." *In: Raidén, A B and Aboagye-Nimo, E (Eds) Procs 31st Annual*

ARCOM Conference, 7-9 September 2015, Lincoln, UK, Association of Researchers in Construction Management, 1249-1258.

FHWA-INVEST. (2012). "Sustainable Highways Self-Evaluation Tool." *Invest 1.0*, <https://www.sustainablehighways.org/INVEST_1.0_Compendium_Web.pdf> (Oct. 10, 2016).

Field, A. (2013). *Discovering statistics using IBM SPSS Statistics. SAGE Publications, Los Angeles.*

Gajurel, A. (2014). *Performance-based contracts for road projects: Comparative analysis of different types.*

Gransberg, D. D., and Barton, R. F. (2007). "Analysis of federal design-build request for proposal evaluation criteria." *Journal of Management in Engineering*, 23(2), 105–111.

Green, B. (2014). *The Real Face of Construction: A Socio-Economic Analysis of the True Value of the BuiltEnvironment. Chartered Institute ofBuilding, Bracknlell, UK.*

Gurgun, A. P., and Touran, A. (2014). "Public-Private Partnership Experience in the International Arena: Case of Turkey." *Journal of Management in Engineering*, 30(6), 4014029.

Hale, D. R., Shrestha, P. P., Gibson, G. E., and Migliaccio, G. C. (2009). "Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods." *Journal of Construction Engineering and Management*, 135(7), 579–587.

Hanák, T., and Muchová, P. (2015). "Impact of competition on prices in public sector procurement." *Procedia Computer Science*, Elsevier Masson SAS, 64, 729–735.

Hosseini, M. R., Banihashemi, S., Martek, I., Golizadeh, H., and Ghodoosi, F. (2018). "Sustainable Delivery of Megaprojects in Iran: Integrated Model of Contextual Factors." *Journal of Management in Engineering*, 34(2), 5017011.

Iles, D., and Ryall, P. (2016). "How can the United Kingdom construction industry implement sustainable procurement strategies?" *Proceedings of the 32nd Annual ARCOM Conference, ARCOM 2016*, 2(September), 1121–1130.

Illankoon, I., Tam, V., and Le, K. (2016). "Environmental , Economic , and Social Parameters in International Green Building Rating Tools." *Journal of Professional Issues in Engineering*

Education and Practice, 1–8.

ISI. (2015). “ENVISION Rating system for sustainable infrastructure.” *Institute for Sustainable Infrastructure*, <https://sustainableinfrastructure.org/portal/files/GuidanceManual.pdf> (Jan. 10, 2017).

Kahlenborn, W., Moser, C., Frijdal, J., and Essig, M. (2010). *Strategic Use of Public Procurement in Europe Financed by : European Commission. Final Report to the European Commission MARKT/2010/02/C*. Berlin: adelphi.

Koolwijk, J. S. J., van Oel, C. J., Wamelink, J. W. F., and Vrijhoef, R. (2018). “Collaboration and Integration in Project-Based Supply Chains in the Construction Industry.” *Journal of Management in Engineering*, 34(3), 4018001.

Korkmaz, S., Riley, D., and Horman, M. (2011). “Piloting Evaluation Metrics for Sustainable High-Performance Building Project Delivery.” *Journal of Construction Engineering and Management*, 136(8), 877–885.

Kornevs, M., Kringos, N., and Meijer, S. (2014). “A research agenda for green procurement of infrastructures.” *2014 International Conference on Engineering, Technology and Innovation: Engineering Responsible Innovation in Products and Services, ICE 2014*, IEEE Computer Society.

Korytárová, J., Hanák, T., Kozik, R., and Radziszewska-Zielina, E. (2015). “Exploring the Contractors’ Qualification Process in Public Works Contracts.” *Procedia Engineering*, 123, 276–283.

Krajangsri, T., and Pongpeng, J. (2017). “Effect of Sustainable Infrastructure Assessments on Construction Project Success Using Structural Equation Modeling.” *JOURNAL OF MANAGEMENT IN ENGINEERING*, 33(3).

Krippendorff, K. (1989). “Content Analysis.” *In E. Barnouw, G. Gerbner, W. Schramm, T. L. Worth, & L. Gross (Eds.), International encyclopedia of communication*, New York, NY: Oxford University Press. Retrieved from http://repository.upenn.edu/asc_papers/226, 1, 403–407.

Kylili, A., Fokaides, P. A., Amparo, P., and Jimenez, L. (2016). “Key Performance Indicators (KPIs) approach in buildings renovation for the sustainability of the built environment : A review.”

Renewable and Sustainable Energy Reviews, Elsevier, 56, 906–915.

Lines, B., and Miao, F. (2016). “Writing More Competitive Proposals: Content Analysis of Selected (and Unselected) Construction Contractor Technical Proposals.” *Construction Research Congress 2016: Old and New Construction Technologies Converge in Historic San Juan - Proceedings of the 2016 Construction Research Congress, CRC 2016*, 457–466.

Lo, W., and Yan, M.-R. (2009). “Evaluating Qualification-Based Selection System: A Simulation Approach.” *Journal of Construction Engineering and Management*, 135(6), 458–465.

Loosemore, M. (2015). “Building a new third construction sector through social enterprise.” *Construction Management and Economics*, 6193(October).

Loosemore, M. (2016). “Social procurement in UK construction projects.” *International Journal of Project Management*, Elsevier Ltd and Association for Project Management and the International Project Management Association, 34(2), 133–144.

Loosemore, M., and Denny-Smith, G. (2016). “Barriers to Indigenous Enterprise in the Australian Construction Industry.” *In:P W Chan and C J Neilson (Eds.) Proceedings of the 32nd Annual ARCOM Conference, 5-7 September 2016, Manchester, UK, Association of Researchers in Construction Management,* 2, 629–638.

Manata, B., Miller, V., Mollaoglu, S., and Garcia, A. J. (2018). “Measuring Key Communication Behaviors in Integrated Project Delivery Teams.” *Journal of Management in Engineering*, 34(4), 6018001.

Molenaar, K. R., and Johnson, D. E. (2003). “Engineering the Procurement Phase to Achieve Best Value.” *Leadership and Management in Engineering*, 3(3), 137–141.

Molenaar, K. R., Sobin, N., and Antillón, E. I. (2010). “A synthesis of best-value procurement practices for sustainable design-build projects in the public sector.” *Journal of Green Building*, 5(4), 148–157.

Molenaar, K. R., Sobin, N., Gransberg, D. G., McCuen, T., Korkmaz, S., and Horman, M. (2009). “Sustainable , High Performance Projects and Project Delivery Methods A State-of-Practice

Report.” *Rep. to the Charles Pankow Foundation, Claremont, CA.*

Mollaoglu-Korkmaz, S., Swarup, L., and Riley, D. (2013). “Delivering Sustainable, High-Performance Buildings: Influence of Project Delivery Methods on Integration and Project Outcomes.” *Journal of Management in Engineering*, 29(1), 71–78.

Mont, O., and Leire, C. (2000). “Socially responsible purchasing in supply chains : drivers and barriers in Sweden.” *Social Responsibility Journal*, 5(3), 388–407.

Naoum, S. G., and Egbu, C. (2016). “Modern selection criteria for procurement methods in construction: A state-of- the-art literature review and a survey.” *International Journal of Managing Projects in Business*, 9(2), 309–336.

Neuendorf, K. A. (2017). *The Content Analysis Guidebook. Sage Publications, Thousand Oaks, CA*.

Okunlola, O. J. O. S. (2012). “PROMA-A decision support system to determine appropriate procurement method.” *Research Journal of Applied Sciences, Engineering and Technology*, 4(4), 316–321.

Olanipekun, A. O., Xia, B. (Paul), Hon, C., and Darko, A. (2018). “Effect of Motivation and Owner Commitment on the Delivery Performance of Green Building Projects.” *Journal of Management in Engineering*, 34(1), 4017039.

Oyegoke, A. S., Dickinson, M., Khalfan, M. M. A., Mcdermott, P., and Rowlinson, S. (2009). “Construction project procurement routes: an in-depth critique.” *International Journal of Managing Projects in Business*, 2(3), 338–354.

Palmujoki, A., Parikka-alhola, K., and Ekroos, A. (2010). “Green Public Procurement : Analysis on the Use of Environmental Criteria in Contracts.” *Review of European Community & International Environmental Law*, 19, 250–262.

Park, J., Ojiako, U., Williams, T., Chipulu, M., and Marshall, A. (2015). “Practical Tool for Assessing Best Value at the Procurement Stage of Public Building Projects in Korea.” *Journal of Management in Engineering*, 31(5), 6014005.

Pellicer, E., Sanz, M. A., Esmaeili, B., and Molenaar, K. R. (2016). “Exploration of Team Integration in

Spanish Multifamily Residential Building Construction." *Journal of Management in Engineering*, 32(5), 05016012.

Petersen, D., and Kadefors, A. (2016). "Social Procurement and Employment Requirements in Construction." *In: P W Chan and C J Neilson (Eds.) Proceedings of the 32nd Annual ARCOM Conference, 5-7 September 2016, Manchester, UK, Association of Researchers in Construction Management*, 2, 997–1006.

Roman, A. V. (2017). "Institutionalizing sustainability : A structural equation model of sustainable procurement in US public agencies." *Journal of Cleaner Production*, Elsevier Ltd, 143, 1048–1059.

Ruparathna, R., and Hewage, K. (2015a). "Review of Contemporary Construction Procurement Practices." *Journal of Management in Engineering*, 31(3), 04014038(1-11).

Ruparathna, R., and Hewage, K. (2015b). "Sustainable procurement in the Canadian construction industry : current practices , drivers and opportunities." *Journal of Cleaner Production*, Elsevier Ltd, 109, 305–314.

Shen, L. Y., Wu, Y. Z., Chan, E. H. W., and Hao, J. L. (2005). "Application of system dynamics for assessment of sustainable performance of construction projects *." (4), 339–349.

Shrestha, P. P., O 'connor, J. T., and Gibson, G. E. (2012). "Performance Comparison of Large Design-Build and Design-Bid-Build Highway Projects." *Journal of Construction Engineering and Management*, 138(1), 1–13.

Sierra, L. A., Pellicer, E., and Yepes, V. (2015). "Social Sustainability in the Lifecycle of Chilean Public Infrastructure." *Journal of Construction Engineering and Management*, 142(5), 5015020.

Sierra, L. A., Pellicer, E., and Yepes, V. (2017). "Method for estimating the social sustainability of infrastructure projects." *Environ. Impact Assess. Rev*, 65(1), 41–53.

Sourani, A., and Sohail, M. (2011). "Barriers to addressing sustainable construction in public procurement strategies." *Engineering Sustainability*, ES4(2010), 229–237.

Sporrong, J., and Kadefors, A. (2014). "Municipal consultancy procurement: New roles and practices."

Building Research and Information, 42(5), 616–628.

Stanford, M., Molenaar, K., and Sheeran, K. (2016). “Application of Indefinite Delivery–Indefinite Quantity Construction Strategies at the Federal Level.” *Journal of Management in Engineering*, 32(5), 4016011.

Sutherland, V., Mctier, A., Glass, A., and Mcgregor, A. (2015). *Analysis of the Impact and Value of Community Benefit Clauses in Procurement*. *Training and Employment Research Unit (TERU). Glasgow: University of Glasgow. Svensson*.

Testa, F., Grappio, P., Gusmerotti, N. M., Iraldo, F., and Frey, M. (2016). “Examining green public procurement using content analysis: existing difficulties for procurers and useful recommendations.” *Environment, Development and Sustainability*, Springer Netherlands, 18(1), 197–219.

Ugwu, O. O., and Haupt, T. C. (2007). “Key performance indicators and assessment methods for infrastructure sustainability — a South African construction industry perspective.” *Building and Environment*, 42(June 1992), 665–680.

Ugwu, O. O., Kumaraswamy, M. M., Wong, A., and Ng, S. T. (2006). “Sustainability appraisal in infrastructure projects (SUSAIP) Part 1 . Development of indicators and computational methods.” *Automation in Construction*, 15, 239–251.

Varnäs, A. (2008). *Enhancing Environmental Performance by Green Procurement: A study of environmental procurement preferences in the construction industry. Stockholm, Sweeden.*

Walker, H., and Phillips, W. (2009). “Sustainable procurement : emerging issues.” *Int. J. Procurement Management*, 2(1), 41–61.

Wang, W. C., Wang, H. H., Lai, Y. T., and Chien Chung Li, J. (2006). “Unit-price-based model for evaluating competitive bids.” *International Journal of Project Management*, 24, 156–166.

El Wardani, M. A., Messner, J. I., and Horman, M. J. (2006). “Comparing Procurement Methods for Design-Build Projects.” *Journal of Construction Engineering and Management*, 132(3), 230–238.

Whyte, J., and Sexton, M. (2011). “Motivations for innovation in the built environment: New directions for research." *Building Research and Information*, 39(5), 473–482.

Winter, S., and Lasch, R. (2016). "Environmental and social criteria in supplier evaluation - Lessons from the fashion and apparel industry." *journal of cleaner produc*, 139, 175–190.

Witjes, S., and Lozano, R. (2016). "Towards a more Circular Economy: Proposing a framework linking sustainable public procurement and sustainable business models." *Resources, Conservation and Recycling*, Elsevier B.V., 112, 37–44.

Wu, G., Zuo, J., and Zhao, X. (2017). "Incentive Model Based on Cooperative Relationship in Sustainable Construction Projects." *Sustainability*, 9, 1191.

Xia, B., Chan, A., Zuo, J., and Molenaar, K. (2013). "Analysis of Selection Criteria for Design-Builders through the Analysis of Requests for Proposal." *Journal of Management in Engineering*, 29(1), 19–24.

Xia, B., Chen, Q., Xu, Y., Li, M., and Jin, X. (2015). "Design-Build Contractor Selection for Public Sustainable Buildings." *Journal of Management in Engineering*, 31(5), 4014070.

Xia, B., Skitmore, M., Wu, P., and Chen, Q. (2014a). "How Public Owners Communicate the Sustainability Requirements of Green Design-Build Projects." *Journal of Construction Engineering and Management*, 140(8), 4014036.

Xia, B., Skitmore, M., Zuo, J., Zhao, Z., and Nepal, M. (2014b). "Defining sustainability requirements for design-build (DB) contractor selection in public sector projects." *Proceedings of the 18th International Symposium on Advancement of Construction Management and Real Estate*, 59–66.

Zhu, Q., Geng, Y., and Sarkis, J. (2013). "Motivating green public procurement in China : An individual level perspective." *Journal of Environmental Management*, Elsevier Ltd, 126, 85–95.

LIST OF TABLES

Table 1. Variables used

Groups	Variables	Source literature
Project characteristics	**Infrastructure type:** Buildings and civil engineering projects	(Gransberg and Barton 2007; Xia et al. 2013)
	Contract size: Initial budget (€)	(Lines and Miao 2016; Stanford et al. 2016; Xia et al. 2013)
	Country: Anglo-Saxon countries (ASCs) and Spanish-speaking countries (SSCs)	(Fatokun et al. 2015; Gajurel 2014)
	Procurement procedure: Lowest price and best value	(Molenaar et al. 2010; Stanford et al. 2016; Xia et al. 2013)
	Project delivery method: Traditional (DBB) and Integrated (DB, CMR, Concessions, PPP, etc.)	(Gransberg and Barton 2007; Naoum and Egbu 2016; Pellicer et al. 2016; Xia et al. 2013)
Social criteria	**Cultural heritage:** Preserve historic and cultural resources	(ISI 2015; Kylili et al. 2016)
	Employment: Contribution to new opportunities of employment, job stability, employment of the vulnerable population, participation of SME, etc.	(Azapagic and Perdan 2000; Balubaid et al. 2015; Shen et al. 2005; Sierra et al. 2017)
	Health and safety: Prevention of accidents or injuries in workplaces and public environments	(Amiril et al. 2014; FHWA-INVEST 2012)
	Training: Improving the workforce skills in technical and sustainability terms	(Sierra et al. 2015)
	Effects on users: Measures to minimize harm to people due to the development of work	(Krajangsri and Pongpeng 2017; Ugwu and Haupt 2007)
	Local: Measures to boost local development in the project	(Dobrovolskiien and TamošiIuniene 2016)
	Professional ethics: Ethical aspects in the development of work and staff recruitment	(Sierra et al. 2015; Ugwu et al. 2006; Ugwu and Haupt 2007)

Table 2. Summary of the data sample

Country	Total (#)	Infrastructure		Contract size				Project delivery method		Procurement procedure	
		Civil engineering	Building	< 1 M€	1 M€-10 M€	>10 M€	Unspecified	Traditional	Integrated	Lowest price	Best value
ASC	181	125 (69%)	56 (31%)	15 (8%)	32 (18%)	20 (11%)	114 (63%)	137 (76%)	44 (24%)	46 (25%)	135 (75%)
SSC	270	208 (77%)	62 (23%)	56 (21%)	126 (47%)	55 (20%)	33 (12%)	225 (83%)	45 (17%)	127 (47%)	143 (53%)

Table 3. Results of logistic regression. Dependent variable: Project delivery method

Independent variables	B	S.E.	Wald	df	Sig.	Exp(B)
Infrastructure	-1.121	0.273	16.840	1	0.000	0.326
Country	0.666	0.271	6.036	1	0.014	1.946
Contract size	-	-	41.785	2	0.000	-
Contract size: 1-0	0.182	0.425	0.183	1	0.669	1.199
Contract size: 2-0	2.097	0.461	20.708	1	0.000	8.144
Constant	-1.532	0.422	13.151	1	0.000	0.216

Note: B: Regression coefficients (in log-odds units); S.E.: square errors; Wald: Wald statistic; df: degrees of freedom; Sig.: 2-tailed *p*-value (significant if < 0.05); Exp(B): log-odds of success. Infrastructure (0: building; 1: civil engineering). Country (0: SSC; 1: ASC). Contract size (0: < 1 M€; 1: 1 M€-10 M€ + unspecified budget; 2: > 10 M€).

Table 4. Results of logistic regression. Dependent variable: Procurement procedures

Independent variables	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Infrastructure	-0.659	0.267	6.116	1	0.013	0.517
Project delivery method	1.253	0.35	12.821	1	0.000	3.500
Country	0.818	0.229	12.727	1	0.000	2.267
Contract size	-	-	32.048	2	0.000	-
Contract size: 1-0	1.568	0.310	25.557	1	0.000	4.799
Contract size: 2-0	2.104	0.412	26.037	1	0.000	8.195
Constant	-0.912	0.344	7.038	1	0.008	0.402

Note: B: Regression coefficients (in log-odds units); S.E.: square errors; Wald: Wald statistic; df: degrees of freedom; Sig.: 2-tailed p-value (significant if < 0.05); Exp(B): log-odds of success. Infrastructure (0: Building; 1: Civil engineering). Project delivery method (0: traditional; 1: integrated); Country (0: SSC; 1: ASC). Contract size (0: <1 M€; 1: 1 M€-10 M€ + unspecified budget; 2: >10 M€).

Table 5. Statistical description of the number of social criteria included in tenders that consider any social criteria

Procurement procedure	Statistical description	SC Phase	AC Phase	TS&CPC Phase	Total
Lowest price	Mean	1.96	0.00	2.90	3.22
	S.D.	1.03	0.00	1.79	1.88
Best value	Mean	1.54	1.53	2.81	3.28
	S.D.	0.68	0.79	1.61	1.58
Mann-Whitney U	Sig.	0.008	-	0.835	0.348

Note: SC: Selection criteria; AC: Award criteria; TS&CPC: Technical specifications and Contract performance clauses; S.D.: Standard deviation.

Table 6. Results of logistic regressions. Dependent variables: social criteria

Dependent variable	Independent variables	Wald	df	Sig.	Exp(B)
Cultural heritage	Contract size	16.433	2	0.000	-
	Contract size: 1-0	11.394	1	0.001	4.880
	Contract size: 2-0	16.374	1	0.000	9.008
	Country	13.249	1	0.000	2.468
	Procurement procedure	8.826	1	0.003	0.469
	Project delivery method	5.595	1	0.018	0.423
	Infrastructure	5.293	1	0.021	2.018
Employment	Contract size	24.633	2	0.000	-
	Contract size: 1-0	16.348	1	0.000	3.804
	Contract size: 2-0	23.994	1	0.000	7.684
	Project delivery method	12.896	1	0.000	0.358
	Country	10.725	1	0.001	2.018
Training	Country	69.631	1	0.000	7.185
Effect on users	Country	69.007	1	0.000	7.405
	Infrastructure	22.648	1	0.000	3.765
Local	Country	82.264	1	0.000	10.742
Professional ethics	Contract size	24.994	2	0.000	-
	Contract size: 2-0	21.361	1	0.000	6294
	Procurement procedure	8.820	1	0.003	0.506
	Country	5.207	1	0.022	1.641

Note: Wald: Wald statistic; df: degrees of freedom; Sig.: 2-tailed p-value (significant if < 0.05); Exp(B): log-odds of success. Project delivery method (0: traditional; 1: integrated); Procurement procedure (0: lowest price, 1: best value); Country (0: SSC; 1: ASC). Infrastructure (0: Building; 1: Civil engineering). Contract size (0: <1 M€; 1: 1 M€-10 M€+unspecified budget; 2: >10 M€).