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# Incorporating Environmental Sustainability into Construction Procurement at the District Assembly Level in Ghana

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**Abstract** There is increasing onus on public organizations in societies to minimize the impacts of their activities on the environment. Construction projects account for high carbon emissions, high water consumptions, greater amounts of landfill wastes and high usage of raw materials. Incorporating environmental sustainability into construction procurement in public sectors should help reduce the effects of such activities on the environment. A questionnaire survey of 88 procurement professionals was conducted to determine the views of the respondents on the parts of tender documents that needed the incorporation of environmental sustainability issues, the stages in the procurement process where environmental sustainability issues may be incorporated, and the significant factors that drive the incorporation of environmental sustainability into construction procurement. These procurement professionals were purposively selected to carry out the study. Data obtained from the survey was analysed using mean score rankings and factor analysis. The findings from the study revealed that 'the contract performance clauses', 'the subject matter of the contract', and 'the contract award criteria', were key among the areas of the tender document where environmental considerations had to be introduced. Also, 'evaluation of tender offers', 'administering contracts and confirmation of compliance with requirement', were among the stages in the procurement process where respondents believed environmental sustainability issues could be introduced. Furthermore, four major factors namely: leadership influence, environmental culture, public influence and personal skills were identified as driving environmental sustainability into construction procurement at the district assembly level in Ghana. This research is of significance as it has highlighted that the identification and inclusion of environmental sustainability issues into construction procurement and tender documents are important factors in environmental management at the district assembly level. Also, it has ascertained that the exploitation of the knowledge of Environmental Officers within the structure of the local government system through the procurement processes is vital to ensure environmentally sustainable construction projects.

**Keywords** Procurement of works, District Assembly level, Environmental sustainability, Ghana

## 1. Introduction

There is increasing onus on public organizations in societies to minimize impacts of their activities on the environment [1, 2]. Governments around the world have been urged to take the lead in introducing environmentally sustainable practices in their own operations, in particular through procurement policies [3, 4]. This is due to the fact that construction activities, especially buildings, embarked on by public organizations contribute to environmental degradation in various ways such as resource depletion, energy consumption, air pollution and waste creation [5-7]. Buildings worldwide account for 20% fresh water consumption, 25% wood harvest, 40% CO2 emissions, 40% energy use and 30% raw material use [8]. Ayarkwa et al. [6] found that the consumption of raw materials from the construction industry leads to major environmental degradation because the consumptions are non-renewable. According to Ofori [9], construction contributes to the loss of forests because the raw materials are consumed and irreversibly converted to timber or other raw materials for construction activities. Ruparathna and Hewage [10] identified that government can play a role in ensuring that green concepts are adopted in procurement through the provision of environmental standards and regulatory frameworks. Recent researchers have identified procurement as a major tool to augment governments' environmental protection efforts, but, it is apparent that none of the major studies in Ghana have identified factors

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that drive environmental sustainability into the construction procurement at the district assembly level [11]. Interestingly, the study conducted by Adetunji et al. [11] revealed that government procurement practices have largely been focused on price, whereas the commitment to environmental sustainability has been an act of faith rather than a contractual deliverable [12]. Varnas et al. [13] revealed that environmental criteria in tender evaluations are less common and seldom affect the award decisions. Furthermore, [14] revealed that the construction industry pays less attention to environmental issues than other issues such as construction cost, construction time, familiarity with the construction technology, and availability of resources. Boyefio, [15] identified efforts by Ghana's Public Procurement Authority to address sustainability in public procurement. The aim of the study was to explore the factors that drive the incorporation of environmental sustainability into construction procurement at the district assembly level. District assemblies in the western region of Ghana were selected because the region is known to have crucial environmental concerns such as large and small scale mining, deforestation, coastal erosion and sanitation, urban sanitation and water hyacinth/ marine pollution [16].

## 2. Study Area

The Western Region covers about 10 per cent of Ghana's total land surface. Occupying an area of 23,921 square kilometres, it is located in the south-western part of Ghana, bordered by Ivory Coast on the West, Central Region on the East, Ashanti and Brong-Ahafo Regions on the North and on the South by 192 km of coastline of the Atlantic Ocean.

The southernmost part, also the southernmost part of Ghana is called Cape Three Points, near Busua. There are 410,142 households in 259,874 houses, which give an average of 1.6 households per house for the region [17]. Most of the houses were built in the cocoa and timber economic boom years of the late 1950s and early 1960s. There is congestion in many houses which has resulted in the construction of new buildings at areas that served as agricultural lands and other purposes. There is the need for measures to reduce the effect of these growing construction activities on the environment. Figure 1 illustrates the map of the study area.

The key environmental concerns in the western region include: impacts of large and small scale mining, deforestation, industrial pollution (disposal of solid waste, effluent discharges and gaseous emissions), coastal erosion and sanitation, urban sanitation, and water hyacinth/ marine pollution. The Western Region was selected based on these growing environmental concerns. These environmental concerns arising from construction activities could be curtailed by incorporating environmental sustainability into construction procurement in the various districts.

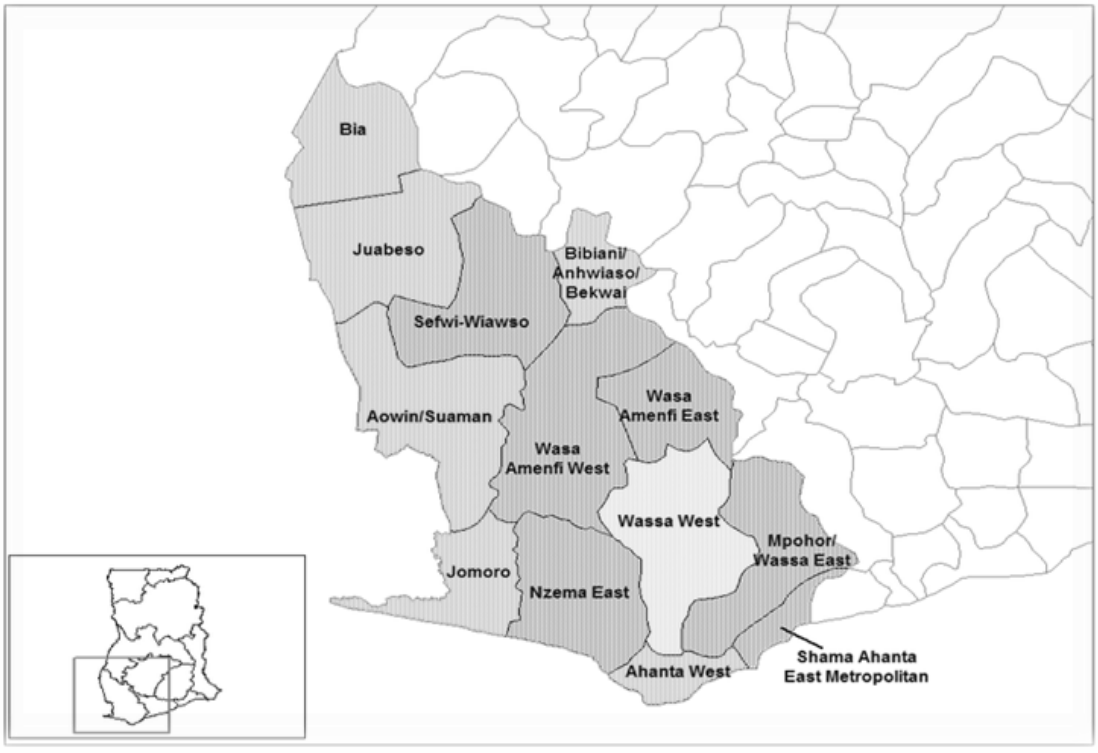


**Figure 1.** Map of Study Area (Western Region)

# 3. Literature Review

## 3.1. Public Procurement of Works in the Ghanaian Context

In the year 1996, the Government of Ghana launched the Public Financial Management Reform Programme (PUFMARP) to improve the overall public financial management in Ghana [18]. The Public Financial Management Reform Programme (PUFMARP) identified weaknesses in the procurement system which includes: no comprehensive public procurement policy [18]. This led to the establishment of the Procurement Oversight Group in 1999 to steer the design of a comprehensive public procurement reform programme. A Drafted public procurement bill was produced in September 2002. The Public Procurement Act, 2003 was passed into law on 31 December 2003 [18]. This has been the legal document governing procurement of works at the district level in Ghana. The Public Procurement Act, 2003 (Act 663) establishes the Public Procurement Authority (PPA), Tender Committees and Tender Review Boards. It specifies rules for procurement procedures, it also defines offences and applicable penalties. Public Procurement Regulations is issued by the Minister for Finance in consultation with PPA under section 97 of the Act and contain detailed rules and procedures for all aspects of the procurement system such as the operations of PPA and procurement entities and the conduct of procurement activities. The Guideline is issued by PPA under the Act and provide supplementary guidance on specific topics e.g. disposal, single source procurement and margins of preference. The standard Tender Documents is issued by PPA and are listed in Schedule 4 of the Act. Separate documents for standard invitation and contract documents for procurement of goods, works and services are provided [18]. According to the Public Procurement Manual [19] of Act 663, "Works" means work associated with the construction, reconstruction, demolition, repair or renovation of a building, a structure or surface, and includes site preparation, excavation, erection, assembly, installation of plant, fixing of equipment and laying out of materials, decoration and finishing, and any incidental activity under a procurement contract. Construction procurement is however confined to construction works, construction procurement includes services, goods, construction works and disposals in the form of demolitions and the disposal of surplus materials, plant and equipment [20]. The process for construction procurement at the district assembly follows the process outlined in the Public Procurement Act. In the current tender documents, there are no provisions for environmental sustainability to be incorporated; there are no competitive clauses to discuss with the contractors, making it difficult for the client to enforce what district perceives as valuable. Figure 2 shows the basic procedure for construction procurement at the district assembly level in Ghana.

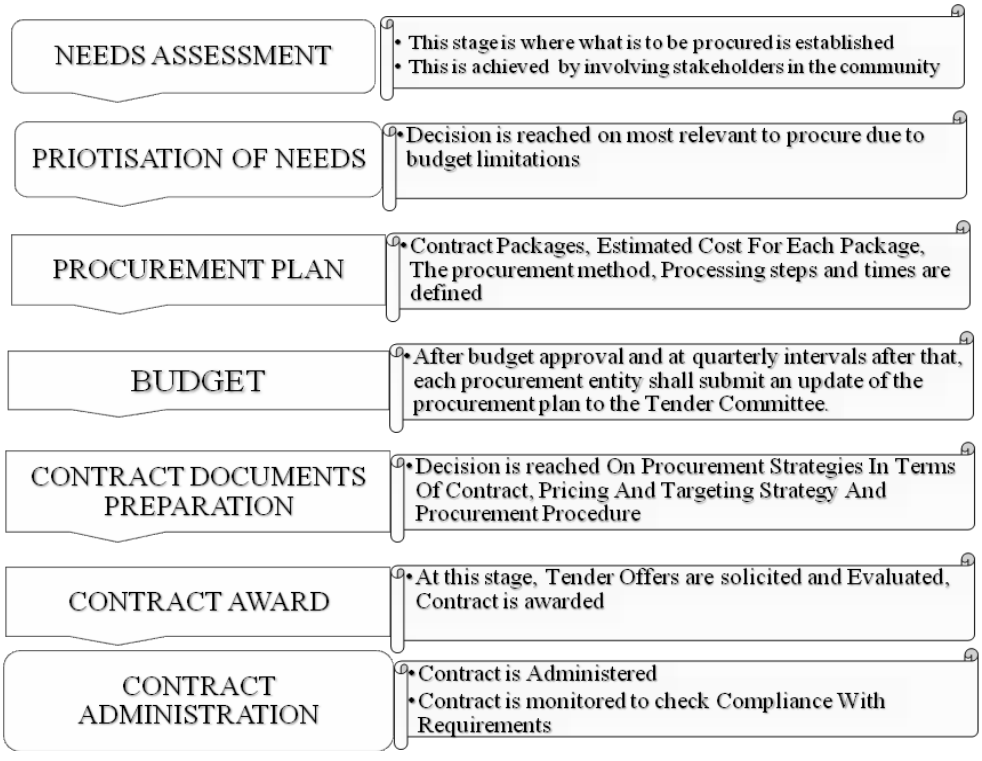


**Figure 2.** Construction Procurement Process at the district assembly level. **Source:** Adapted from the Public Procurement Manual (2003) of Act 663

### 3.2. Environmental Responsibilities at the District Assembly Level in Ghana

The Constitution of the Republic of Ghana [21] requires all citizens of Ghana to protect and safeguard the environment as stipulated in chapter six, article 41 (k). Also, the Environmental Protection Agency Act (Act 490) mandates the Environmental Protection Agency to ad infinitum improve and preserve the country's environment. Again the constitution grants the District Assemblies the highest political authority in the district, and that the District Assembly has deliberative, legislative and executive powers. The Local Government Act No. 462 of 1993 and the National Development Planning (System) Act 480 of 1994 are some of the main legislative texts pertaining to District Assemblies. The Assemblies have an executive committee, which is headed by a District Chief Executive who is appointed by the President. The District Chief Executive has significant authority over the affairs of the Assembly. Community Environmental Management Committees are set up and undergo training under the

Ghana Environmental Management Project (GEMP) which was initiated in 2008 and funded by the Canadian International Development Agency (CIDA). The District Planning officer is the team leader of the District Environmental Management Committee. Members of the District Environmental Management team are the National Disaster Management Committee (NADMO), the Environmental Health and Sanitation Unit, District Community Development Officer, the Ghana Education Service (GES), the Department of Social Welfare, the Gender Desk office, the representatives of traditional rulers, the Town and Country Planning, and the Police Force, most of whom are given further training. The Environmental Management Committee respond to reports of activities that degrade the environment [22]. The Local Government Act of 1993 prescribes to the District Assemblies broad mandates. The District Assemblies deliver many services, such as pre- and primary education, social welfare, health clinics, cemeteries, museums and libraries, water and sanitation, refuse collection, environmental protection and transport, with many of these having environmental impacts [23]. The district assemblies together with district environmental management committees are responsible for local management of the environment.

### 3.3. Drivers to the Incorporation of Environmental Sustainability into Construction Procurement

Several drivers to the incorporation of environmental sustainability into procurement management were identified from literature and are discussed to include the following:

Skilful policy entrepreneurs, Personal commitment, Extension of Founder's Value, Values of Owner, and Desire to Improve Position: In order to incorporate environmental sustainability into construction procurement, it is believed that the personal skills and commitment of the procurement officer plays a key role [24]. Wycherley [25] found that the personal and ethical values of the founder of a company could filter through an organisation. At the district assembly level, the District Chief Executive representing government should have passion for the environment and find ways to promote environmental protection in their districts [25]. Will the commitment of environmental stakeholders be found to be a driving factor to environmental considerations in procurement management at the district level?

Desire to reduce costs, improve quality, desire to reduce risk of consumer criticism, pressure from investors, and desire to manage economic risks. The desire to reduce costs represents a common driving force for environmental considerations in projects [24]. Costs can be prevented by embracing the concept of pollution prevention [24]. There is need to find out whether it is same in the construction sector in Ghana.

Legislative and Regulatory compliance and ISO 14000 certification: government regulation and legislation appears to be a strong driver for environmental projects [24]. Companies that have the ISO certification appear to have improved environmental performance [26]. Environmental regulations promote the reduction of environmental impact at low cost compared to cost of litigation. Since these regulations govern all procurement activities in the public sector, their availability may be key to the promotion of environmental sustainability.

Investor pressure, Pressure from customers, Public pressure, Non-economic Stakeholders and Pressure by Environmental Advocacy Groups: According to Walker et al. [24], increased customer pressure and investor pressure may be enough to drive environmental sustainable practices into the procurement process. Projects from donor supported funds perform better environmentally due to pressures from the donors [27]. Stakeholder groups as well as non-organisational stakeholders can pressure public organisations which have a much bigger purse to address environmental concerns [28]. The voice of activist campaigners, non-governmental organisations (NGOs) or green pressure groups cannot be ignored anymore, as they have the ability to seriously embarrass non-compliant organisations [29].

Gaining competitive advantage, potential for receiving publicity: According to Gonzalez-Benito and Gonzalez-Benito, [30], a policy of environmental purchasing may not be undertaken because of a desire to protect world resources, but to gain competitive advantage and improve the financial performance of the institution. Since the districts are known to compete for resources, an improved environmental performance may be an advantage. The deterioration of the environment over recent years has drastically increased public awareness of environmental sustainability.

## 4. Research Methodology

The study implored exploratory research methods.

Purposive sampling was used to identify the population for the study namely: procurement officials, environmental officers, quantity surveyors, and district engineers. The inclusion of these officers helped the researchers to know the relevant environmental problems that could be solved through the procurement process and helped in bringing out the driving factors pushing environmental sustainability into the procurement process. There are 22 district assemblies in the region and a census sampling technique was used to select all the twenty-two districts. Sample frame was collected from Western Regional Coordination Council. The sample size was eighty-eight (88) people drawn from the population of twenty-two (22) districts in the Western Region of Ghana. The population were in four subgroups of twenty-two each from district engineers, procurement officers, environmental officers, and procurement officers. Questionnaires were administered personally and the personal visits to the respondents took place over a period of three months between May 2015 and July 2015.

In all, 88 questionnaires were distributed personally to respondents. Out of this figure, 22 were given to procurement officers, quantity surveyors, district engineers, and the rest were given to environmental officers. Sixty questionnaires were retrieved and this made the response rate stand at 68 percent. The questionnaire consisted of both open and closed ended questions. The questionnaire was used because respondents could be able to respond to the questions unaided. Also, the questionnaire facilitated the collection of data that ensured the best matching of concepts with reality. It was divided into four parts. The first part sought the demography of the respondents. The second part required the respondents to score on the Likert scale of 1 to 5 (where 1 = strongly disagree and 5 = strongly agree) their levels of agreement to the parts of the tender documents where environmental issues may be incorporated. Part C of the questionnaire required the respondents to score on the Likert scale of 1 to 5 (where 1 = strongly disagree and 5 = strongly agree) their level of agreement to the stages in the procurement process where environmental issues may be incorporated. The final part of the questionnaire required the respondents to score on the Likert scale of 1 to 5 (where 1 = highly insignificant and 5= highly significant) the significant factors that drive the incorporation of environmental sustainability into construction procurement. About fifteen factors that drive the incorporation of environmental sustainability into construction procurement were identified from literature for the respondents to score. For ease of analysis of the data, the fifteen variables were coded from V1 to V15.

Data from the survey was analysed by mean score rankings and factor analysis.

# 5. Results

## 5.1. Drivers to the Incorporation of Environmental Sustainability into Construction Procurement

Out of the total number of 88 questionnaires sent, 60 responses were received representing a responsive rate of 68%.

**Table 1.** MMDAs in the Western Region Used in the Research

| LI | Metropolitan | Capital | Number of Respondents |
|---|---|---|---|
| 1928 | Sekondi-Takoradi | Sekondi | 4 |
| | Municipal Assemblies | | |
| 1886 | Tarkwa Nsuaem | Tarkwa | 4 |
| 1917 | Nzema East | Axim | 4 |
| 2015 | Sefwi Wiaso | Sefwi Wiaso | 4 |
| | District Assemblies | | |
| 1387 | Bibiani/Ahwiaso/Bekwai | Bibiani | 4 |
| 1394 | Jomoro | Half Assini | 4 |
| 1395 | Ahanta West | Agona Nkwanta | 4 |
| 1757 | Amenfi West | Wassa Akropong | 4 |
| 1840 | Prestea-Huni Valley | Bogoso | 4 |
| 1882 | Shama | Shama | 4 |
| 1884 | Sefwi Akontobra | Sefwi Akontobra | 4 |
| 1918 | Ellembele | Nkroful | 4 |
| 2011 | Wassa Amenfi Central | Manso | 4 |
| 2012 | Wassa Amenfi West | Asankrogua | 4 |
| 2013 | Bia West | Essam-Dabiso | 4 |
| 2014 | Bia East | Adabokrom | 4 |
| 2016 | Suaman | Dadieso | 4 |
| 2017 | Aowin/Suaman | Enchi | 4 |
| 2018 | Wassa East | Daboase | 4 |
| 2019 | Mpohor | Mpohor | 4 |
| 2020 | Juaboso | Juaboso | 4 |
| 2021 | Bodie | Bodie | 4 |
| 22 | | | 88 |

## 5.2. Parts of the Tender Documents to Insert Environmental Sustainability Issues

Respondents were asked to indicate which part of the tender documents were relevant areas to insert environmental considerations. Table 2 shows the responses of the various respondents interviewed. Table 2 shows that the mean scores of all the factors considered are greater than the mean value of 3.0 as used in this study. Thus, in the opinion of the respondents, all the five areas were considered as relevant areas to insert environmental considerations. The results further show that, ‘the contract performance clauses’, ‘the subject matter of the contract’, ‘the contract award criteria’, ‘technical specifications for the product/work/service’, and ‘the selection criteria for candidates’, are all areas of the tender document where environmental considerations should be introduced.

The results emphasized that, in all parts of a tender document, environmental sustainability issues may be incorporated, but only with the involvement of Environmental Officers would this be realised since they have the environmental responsibility at the district level. The key issue is not to breach the basic procurement ethics [4, 31, 19]. This is a good signal that portrays opportunity for environmental considerations even with the current procurement system in Ghana.

### 5.3. Stages to Incorporate Environmental Sustainability in the Construction Procurement Process

Respondents were further asked to indicate the stages in the procurement process where environmental sustainability issues should be introduced. Table 3 shows the responses of the various respondents interviewed. Table 3 shows that the mean scores of 5 out of the six stages considered are greater than the mean value of 3.0. Thus, in the opinion of the respondents, 'evaluation of tender offers', 'administering contracts and confirmation of compliance with requirement', 'establishment of what is to be procured', soliciting tender offers', and 'decision on procurement strategies in terms of contract, pricing and targeting strategy and procurement procedures' are the stages in the procurement process where environmental sustainability issues could be introduced. Respondents however, disagreed to the fact that environmental sustainability issues should be included in the 'award of contracts'. These findings agree and disagree with literature at the same time. The agreement is as a result of the fact that five out of the six stages were considered to be areas to consider the incorporation of environmental sustainability issues.

Theory however suggests that all stages are relevant areas to include an environmental issue [4]. It can be concluded that, in totality, almost all the respondents agreed that at each stage of the tendering process, environmental sustainability could be incorporated though there was inconsistency in agreement among the respondents. The key issue here is that basic procurement ethics must not be breached [4, 31, 19].

### 5.4. Factors Driving the Incorporation of Environmental Sustainability into Construction Procurement at the District Assembly Level

Respondents were further asked to indicate the factors that drive the incorporation of environmental sustainability into construction procurement at the District Assembly level. Table 4 presents the views of the respondents.

Table 4 shows that the mean scores of 11 out of the 15 factors considered were greater than the mean value of 3.0. Thus in the opinion of the respondents, 'reduced risk of consumer criticism', 'legislature and legal compliance', 'desire to manage economic risk', 'developing good image', and 'gaining competitive advantage', were considered as the 5 key factors that drive the incorporation of environmental sustainability into construction procurement. The other factors identified include 'government pressure', 'ISO 14001 Certification', 'consensus on standard EMS needed in the sector', 'awareness of environmental impacts', 'environmental culture among competitors', and 'potential for receiving publicity'.

**Table 2.** Parts of the Tender Document to Incorporate Environmental Sustainability Issues

| Parts of the Tender Document | Mean | Std. Deviation | Rank |
|---|---|---|---|
| The Subject Matter of the Contract | 4.27 | 1.023 | 2nd |
| Technical Specifications for the Product/Work/Service | 4.15 | .899 | 4th |
| The Selection Criteria for Candidates | 3.98 | 1.000 | 5th |
| The Contract Award Criteria | 4.27 | 1.103 | 3rd |
| The Contract Performance Clauses | 4.43 | .789 | 1st |

Using the t-test indicates that the score is significantly above 3.0 at 5% level

**Table 3.** Stage of Procurement where Environmental Sustainability Issues should be Incorporated

| Stages of Procurement | Mean | Std. Deviation | Rank |
|---|---|---|---|
| Establishing What is to be Procured | *3.98 | 1.242 | 3rd |
| Decision on Procurement Strategies in terms of Contract, Pricing and Targeting Strategy and Procurement Procedure | *3.87 | 1.142 | 5th |
| Soliciting Tender Offers | *3.90 | 1.175 | 4th |
| Evaluation of Tender Offers | ***4.20** | **1.132** | **1st** |
| Award of Contract | **2.12** | **1.195** | **6th** |
| Administering Contracts and Confirmation of Compliance with Requirement | *4.10 | 1.160 | 2nd |

Using the t-test * indicates that the score is significantly above 3.0 at 5% level

**Table 4.** Factors Driving the Incorporation of environmental Sustainability into Construction Procurement at the District Assembly level

| Code | Factors | Mean | Std. Deviation | Rank |
|---|---|---|---|---|
| V1 | Gaining competitive advantage | ***4.09** | 1.11 | 5th |
| V2 | Government pressure | ***3.91** | 1.18 | 6th |
| V3 | Investor pressure | **1.49** | **0.61** | **15th** |
| V4 | Awareness of environmental impacts | ***3.65** | 1.27 | 9th |
| V5 | Consensus on standard EMS needed in sector | ***3.73** | 1.34 | 8th |
| V6 | Environmental culture among competitors | *3.56 | 1.39 | 10th |
| V7 | Society pressure | 2.35 | 0.93 | 14th |
| V8 | Legislature and Legal compliance | ***4.60** | 0.66 | 2nd |
| V9 | Develop good image | ***4.24** | 0.98 | 4th |
| V10 | Desire to improve quality on performance | 1.91 | 0.89 | 13th |
| V11 | Skilful policy procurement/environmental officers | *3.22 | 1.34 | 12th |
| V12 | ISO 14001certification | **3.87** | 1.09 | 7th |
| V13 | Desire to manage economic risk | ***4.45** | 0.74 | 3rd |
| V14 | Potential for receiving publicity | *3.31 | 1.41 | 11th |
| V15 | Reduced risk of consumer criticism | ***4.85** | **0.36** | **1st** |

Using the t-test *indicates that the score is significantly above 3.0 at 5% level

**Table 5.** Correlation Matrix

| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | $V_6$ | $V_7$ | $V_8$ | $V_9$ | $V_{10}$ | $V_{11}$ | $V_{12}$ | $V_{13}$ | $V_{14}$ | $V_{15}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $V_1$ | 1.00 | | | | | | | | | | | | | | |
| $V_2$ | 0.09 | 1.00 | | | | | | | | | | | | | |
| $V_3$ | -0.23 | 0.09 | 1.00 | | | | | | | | | | | | |
| $V_4$ | **0.22** | 0.13 | 0.13 | 1.00 | | | | | | | | | | | |
| $V_5$ | 0.15 | 0.28 | 0.03 | 0.27 | 1.00 | | | | | | | | | | |
| $V_6$ | 0.42 | 0.17 | -0.03 | 0.32 | **0.60** | 1.00 | | | | | | | | | |
| $V_7$ | 0.27 | 0.00 | -0.01 | 0.28 | 0.38 | **0.44** | 1.00 | | | | | | | | |
| $V_8$ | **0.33** | -0.10 | **-0.29** | **0.39** | 0.15 | **0.33** | 0.23 | 1.00 | | | | | | | |
| $V_9$ | 0.29 | 0.02 | -0.26 | 0.10 | 0.23 | 0.27 | 0.19 | 0.41 | 1.00 | | | | | | |
| $V_{10}$ | -0.07 | -0.06 | 0.19 | 0.09 | 0.07 | -0.08 | -0.01 | **-0.10** | -0.08 | 1.00 | | | | | |
| $V_{11}$ | -0.29 | 0.27 | 0.14 | 0.15 | **0.33** | 0.25 | 0.18 | 0.04 | 0.21 | -0.05 | 1.00 | | | | |
| $V_{12}$ | 0.07 | **0.44** | 0.04 | 0.17 | 0.23 | 0.04 | -0.07 | -0.07 | -0.25 | 0.12 | 0.10 | 1.00 | | | |
| $V_{13}$ | 0.17 | 0.20 | **-0.09** | 0.07 | 0.22 | 0.22 | -0.07 | 0.38 | 0.31 | -0.22 | 0.25 | 0.05 | 1.00 | | |
| $V_{14}$ | -0.17 | **0.33** | 0.12 | 0.23 | **0.38** | 0.28 | -0.08 | -0.06 | -0.31 | 0.21 | 0.21 | **0.63** | 0.09 | 1.00 | |
| $V_{15}$ | -0.20 | -0.08 | -0.09 | -0.03 | 0.19 | -0.06 | 0.04 | 0.14 | 0.05 | **0.02** | 0.15 | -0.05 | 0.11 | -0.02 | 1.00 |

Table 5 represents the correlation matrix of the data. The correlation matrix helps in determining the relationship between the various factors. The highest correlation is between V14 (potential for receiving publicity) and V12 (ISO 14001certification) with the value of 0.63. The second highest correlation is between V6 (environmental culture among competitors) and V5 (consensus on standard EMS needed in sector) with the value of 0.60. Other correlations like V7 (Society pressure) and V6 (environmental culture among competitors), V12 (ISO 14001 certification) and V2 (government pressure) have moderate high correlation, 0.44. Furthermore, a correlation of 0.33 was observed between V8 (legislature and legal compliance) and V6 (environmental culture among competitors), V8 (legislature and legal compliance) and $V_1$ (gaining competitive advantage), and $V_{11}$ (Skilful policy procurement/environmental officers) and $V_5$ (consensus on standard EMS needed in sector). Similar correlations can be found between other variables in Table 5.

The KMO statistic varies between 0 and 1 with a value of zero indicating that the sum of partial correlations is large relative to the sum of correlations. This indicates that there is diffusion of pattern of the correlations, and hence factor analysis is likely to be inappropriate [32]. A value close to 1.00 indicates that patterns of correlation are relatively

compact and so factor analysis should yield distinct and reliable factors [32]. However, literature recommends that the KMO value should be greater than 0.50 if the sample size is adequate [33, 32].

**Table 6.** KMO and Bartlett's Test

| Measure | value |
|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | 0.77 |
| Bartlett's Test Critical Value | 234.44 |
| Bartlett's test degree of freedom | 105 |
| Bartlett's significant value | 0.00 |

With the KMO value of 0.77, as indicated in Table 6, it means that the factors are meritoriously adequate for factoring. This suggests that factor analysis is appropriate and correlation matrix is appropriate for factoring. The Bartlett's test of Sphericity is also significant (a p - value of 0.00 at a large chi-square value of 234.44), an indication that factor analysis can be conducted. The correlation analysis, the KMO and the Bartlett's tests above suggest that, there are correlations among the indicator variables and hence, we can subject the original 15 indicators to a factor analysis procedure.

**Table 7.** Total Variance Explained

| Component | Total | % of Variance | Cumulative % |
|---|---|---|---|
| 1 | 4.85 | 28.56 | 28.56 |
| 2 | 2.98 | 17.55 | 46.11 |
| 3 | 1.98 | 11.62 | 57.73 |
| 4 | 1.39 | 8.20 | 65.93 |
| 5 | 1.29 | 7.57 | 73.50 |

Using the Eigenvalue greater than one rule, the first factor explained about 28.56% of the data. The second factor also explained about 17.55% of the data which was not explained by the first factor. The third factor explained about 11.62% of the data which was not indicated by the first and second factors. The fourth factor explained about 8.20% of the data which was not explained by the first three factors. In all a cumulative percentage of about 65.93% was obtained, indicating that it is highly significant to explain the total variations in the data.

From Figure 3, it can be seen that the 'elbow' of the diagram occurs at the fourth component. This intends depicts that, the number of factors that must be considered for extraction is four (4) but must not exceed five.

Setting a cut-off point of 0.5, the following factor groupings were obtained. Table 8 presents the results of the rotated component matrix. The interpretability of results can be improved through rotation [34]. The rotated factor solution is displayed by default and is essential for interpreting the final rotated analysis. Rotation suggests the behaviour of the variables under extreme conditions and maximizes the loading of each variable on one of the extracted factors whilst minimizing the loading on all other factors and it is the best factor output solutions for interpreting factor analysis [33]. Upon critical examination of inherent relationships among the various factors identified, the various principal components were named. The names of various principal components were formed based on the factors with the highest loadings and the understanding of the relevance of these factors in the context of the study. The various principal components extracted are: Component 1: Leadership Influence; Component 2: Environmental culture; Component 3: Public Influence and Component 4: Personal Skills.

**Table 8.** Rotated Factor Matrix

| | | Component | | | |
|---|---|---|---|---|---|
| Code | Variable | 1 | 2 | 3 | 4 |
| V1 | Gaining competitive advantage | 0.02 | 0.39 | 0.37 | -0.80 |
| V2 | Government pressure | 0.92 | 0.02 | 0.52 | 0.03 |
| V3 | Investor pressure | 0.06 | -0.04 | -0.14 | 0.16 |
| V4 | Awareness of environmental impacts | 0.24 | 0.21 | -0.20 | 0.03 |
| V5 | Consensus on standard EMS needed in sector | 0.36 | 1.09 | 0.07 | 0.24 |
| V6 | Environmental culture among competitors | 0.13 | 1.22 | 0.18 | -0.07 |
| V7 | Society pressure | -0.18 | 0.48 | 0.08 | 0.03 |
| V8 | Legislature and Legal compliance | -0.09 | 0.17 | 0.13 | -0.09 |
| V9 | Develop good image | -0.25 | 0.28 | 0.60 | 0.04 |
| V10 | Desire to improve quality on performance | 0.04 | 0.04 | -0.42 | 0.05 |
| V11 | Skilful policy procurement/environ officers | 0.27 | 0.27 | 0.42 | 1.13 |
| V12 | ISO 14001certification | 0.91 | 0.02 | -0.18 | -0.10 |
| V13 | Desire to manage economic risk | 0.14 | 0.13 | 0.33 | 0.05 |
| V14 | Potential for receiving publicity | 1.04 | 0.43 | -0.67 | 0.25 |
| V15 | Reduced risk of consumer criticism | -0.03 | 0.03 | 0.00 | 0.09 |

From Table 9, it can be deduced that, the second component, 'Environmental Culture', is the first most important component, followed by the first (Leadership Influence), the fourth (Personal skills), and the third (Public Influence) components respectively.

**Table 9.** Varimax Transformation Matrix

| Component | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 0.55 | **0.74** | 0.07 | 0.20 |
| 2 | **-0.67** | 0.40 | 0.47 | -0.29 |
| 3 | -0.21 | -0.05 | 0.39 | **0.88** |
| 4 | -0.38 | 0.04 | **-0.70** | 0.32 |

# 6. Discussions of Results

## 6.1. Factors Driving the Incorporation of Environmental Sustainability into Construction Procurement at the District Assembly Level

The discussions herein are based on the components extracted with their respective factor loadings.

*Component 1*: *Leadership Influence:* It was observed that, component one loads highly on V2 (government pressure-0.92), V12 (ISO 14001certification- 0.91) and V14 (potential for receiving publicity-1.04). Thus the factor here is named leadership influence. From Table 7, this cluster accounted for 28.56% of the total variance. A significant body of research indicates that government pressure is a major driver for a company's environmental efforts [24, 11, 13]. According to Walker et al. [24] government can play a leading role in driving environmental sustainability into the procurement process. This could be done by creating the opportunity in the form of procurement legislature and laws that allow for environmental sustainability to be incorporated into the construction procurement process for implementation at the district level. This agrees with the findings of Ruparathna and Hewage [10] that government plays a crucial role in ensuring that green concepts are adopted in procurement through the provision of environmental standard and regulatory framework. According to Walker [24], ISO certification drives the incorporation of environmental sustainability into the procurement process. Literature agrees with the findings, that current procurement laws in Ghana addresses few sustainability issues [15], and that the government must take the lead in promoting environmental friendly practices through more proactive environmental legislature specially designed for procurement of works.

*Component 2*: *Environmental culture:* Component two loads highly on V5 (consensus on standard EMS needed in sector-1.09) and V6 (environmental culture among competitors-1.22). Thus the factor here is named environmental culture. From Table 7, this cluster accounted for 17.55% of the total variance. These two factors indicate that to be able to incorporate environmental issues into construction procurement there is the need for Procurement Officers and District Engineers to develop an environmental culture enabled by a common Environmental Management Standard available for implementation in the various districts. This would enable an effective Environmental Management System to be established among all the districts [30].

*Component 3*: *Public Influence:* The third component loaded highly on V14 (potential for receiving publicity-0.67), V9 (develop good image-0.6) and V2 (government pressure-0.52), thus the factor is named public influence. From Table 7, this cluster accounted for 11.62% of the total variance. This result agrees with literature. Walker [24] observed that public awareness on environmental impact of construction activities is drastically increasing, and this generates pressure to improve environmental performance in the construction industry. Public pressure and stakeholders are causing firms to review their environmental supply practices [35]. Some non-governmental organisations (NGOs) are putting pressure on organisations to improve their environmental performance [29].

*Component 4: Personal Skills*: Component four loads highly on V11 (Skilful policy procurement/environmental officers-1.13) and V1 (gaining competitive advantage-0.80), thus the factor is named personal skills. From Table 7, this cluster accounted for 8.2% of the total variance. This agrees with the observation by Walker [24] that in order to incorporate environmental sustainability into construction procurement, personal skills of responsible officers are key. Improvement on the financial performance of the district and reduction in cost of environmental impacts of construction procurement activities would enable the district to gain a competitive advantage over other districts, especially in competing for the national purse, but this can only be achieved through the personal skills of responsible officers for construction procurement at the various districts [30]. This calls for the need to improve the skills of District Engineers and Procurement Officers in ways environmental sustainability may be incorporated in a contract and be made contractually enforceable.

# 7. Conclusions

The survey responses highlighted that all key stakeholders; namely District Engineers, Environmental Officers, Quantity Surveyors and Procurement Officers, have a considerable role to play across all the stages of procurement. It was evident from the survey results that the major factors driving the incorporation of environmental sustainability into construction procurement are the desire to reduce risk of consumer criticism (in this case community members), legislature and legal compliance, desire to manage economic risk, and desire to develop good image. Factor Analysis enabled these factors to be put together under four components namely: leadership influence, environmental culture, public influence and personal skills. The study identified 'Environmental Culture', as the first most important component that drives the incorporation of

environmental sustainability into construction procurement at the district level, followed by 'Leadership Influence', 'Public Influence' and 'Personal Skills'. There is the need for an environmental culture among stakeholders to be developed, and enabled by a common Environmental Management Standard available for implementation in the various districts. The personal and ethical values on the environment of Environmental Officers, District Engineers, Procurement Officers and Quantity Surveyors in the various districts could filter through the whole organization if these professionals are proactive. Interestingly, Environmental Officers are seldom consulted in most of the construction activities that take place at the district level. It has become necessary to include Environmental Officers as key members of the works department at the district assemblies since there is constant degradation of the forest, farm lands, water bodies, and constant air and noise pollution. Environmental officers seem to be the best expertise at the district level to highlight these problems in the procurement process and to help the various district assemblies to develop good environmental cultures. This research has highlighted that the identification and inclusion of environmental sustainability issues into construction procurement and tender documents are important factors in environmental management at the district assembly level. Also, it has been ascertained that the exploitation of the knowledge of Environmental Officers within the structure of the local government system through the procurement processes is vital for the acquisition of added value environmentally sustainable construction projects.

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