The Cost of Green Consideration

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This paper explores some of the issues surrounding one of the chief environmental policy tools available to governments: green public procurement. More specifically, the implementation of green criteria into the public tendering process in analysed. The selection procedure for suitable suppliers of public goods and services is assessed through a theoretical framework, pointing to the challenges and possibilities that arise with the inclusion of green variables at each step of the tendering process. The aim is to support future researchers with the development of an overarching framework for the measurement of the costs of social consideration into public procurement. Through the analysis of current published literature and legal documentation, this paper finds that the future development of such a framework may be arduous due to the presence of multiple hampering variables, such as the diversity of green criteria at professionals' disposal and lack of through and comprehensive cost measurement tools.

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procurement; GPP; green criteria; tendering; costs

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1. INTRODUCTION

As current economic practices and consumption patterns are putting the world resources under a strain, the importance of the environment has never been subject to more attention. An ever increasing number of academics and practitioners have been stressing the importance of sustainable practices, with national and supranational institutions calling for global political and financial efforts as to reverse the present imbalances between human activity and natural resources: the 7th UN Millennium Development Goal is 'ensuring environmental sustainability' (United Nations MDG, 2014). But how to do so?

The most critical driver of environmental sustainability is likely to be the decisions we make with regards to the products and services we acquire. While citizens and companies worldwide should take the responsibility to spend their incomes on goods and services that can be deemed to be sustainable, that is, whose production and deployment minimizes negative impacts on planet earth, it is publicly elected governments and other official institutions, with their multiplicity of often value-laden goals, that should lead by example and invest into sustainable practices (Rainey, 2014; Day, 2005).

In light of the above discussion, it is only natural that green public procurement (GPP) is a high-profile business matter these days and that governments worldwide are increasingly concerned with the implementation of sustainable practices into their procurement activities (Marron, 2003; Lundberg et al., 2015). However, while a great deal of scientific research and literature is arguing for the value of sustainable consumption patterns and activities, little is known about the costs of implementing such green practices, making it impossible to consistently assess their very beneficial value.

Due to the existence of such a striking literature gap between the socio-economic value of sustainable practices and the lack of established literature and knowledge regarding their cost (and thus their long-term financial effectiveness), this paper sets to explore the issues surrounding the measurement of the cost of green criteria consideration in public procurement.

2. PROBLEM STATEMENT

As discussed in the previous section, governments and other public institutions must do their ultimate best to reduce the environmental impact of their own activities, since they are major consumers themselves and must at the same time lead by example in the race towards more sustainable and eco-friendly consumption patterns (Day, 2005).

Public procurement is in a central position to drive such sustainable way of thinking since it oversees and utilizes a massive amount of public finances: latest estimations set the expenditure of public procurement in EU countries at as much as 19% of total EU GDP, about two trillion Euros (European Commision, 2012). Obviously, were these financial figures spent in an environmentally friendly way, the adverse impact of European countries and citizens on the environment would be significantly reduced. Green expenditures in the private sector would increase too, further enhancing the beneficial effects of GPP (Marron, 2003; Simcoe & Toffel, 2014).

However, while the benefits of green public procurement, and of green practices in general, have received great academic and professional research over the past few decades, the economic impacts, including the costs, very little in comparison, with no studies addressing green supplier selection directly (Igarashi et al., 2013). But since the *value* of something, in this case of green procurement practices, is generally measured in terms of *benefits* compared to *costs*, the latter part of the function is equally important in measuring GPP value and effectiveness. Assuming that managerial and procurement decisions are made under conditions of rationality, thorough information is needed if we want practitioners worldwide to consistently implement green procurement practices: they should be able to assess not only the benefits, but also the costs of implementing these practices.

On top of the large expenditures commanded by public procurement offices, this problem is also relevant for governance and policy making. For example, how can we measure the performance and the operational impact of public agencies? If we are not able to assess operational performance of agencies, how can we assess the validity of GPP as a monetary environmental policy tool? Moreover, how can we ensure that the price paid for the goods and services purchased by the state (or any other public entity) is a fair price, in that it reflects the real value of that product/service? Or more specifically, are the negative externalities incurred by the production and deployment of that product/service being included in the price per unit? In another question still, how should the state assess different offers when divesting public property? Should the future utilization of the divested assets be part of the evaluation process and if so, to what extent and how to implement such criteria?

Due to the diversified nature of public procurement's tasks, the importance of a framework for assessing the costs of green procurement arises in a number of policy making occasions, though they all lead to the same central question: how much does it cost to be sustainable? Another important question with regards to the costs of GPP is by whom are these costs incurred? And relatedly, what roles do externalities play in the cost/benefit analysis of GPP? Externalities are defined as the effects of production or consumption on third parties (Begg & Ward, 2009). These effects can be quite complex, multifaceted and far-reaching whereby it is hard to thoroughly include them in any cost/benefit calculation. Clearly though, any attempt to measure the costs of implementing green criteria within the public procurement process must address externalities to some extent, whereby it is possible to say that any per-unit price premium paid by public agencies to obtain environmentally friendlier products and services does not fairly represent the true cost of GPP. In fact, not including green criteria into the procurement process translates into various types of environmental and social costs: how to combine these costs into any GPP costs calculation? Which time scale should be adopted when including positive and negative externalities of GPP practices and non-practices? These are complex questions that require extensive theoretical and practical longitudinal studies: this paper will however start exploring these issues, providing insights into the possibilities and challenges of measuring the costs of green criteria inclusion in the public procurement process.

Although the public tendering process has multiple stages and comprises various activities of different nature (Igarashi et al., 2013; Van Weele, 2010), the scope of this paper is limited to the inclusion of green criteria at the three key, central stages of the tendering process: the product specification stage, the supplier qualification stage and, lastly, the contract award stage.

Procurement professionals lack a consistent and scientifically proven method for assessing the cost of including sustainability measures in the tendering process. In other words, practitioners don't exactly know how much it costs to be environmentally

friendly. As current literature does not yet provide a thorough and overarching solution to this question, this paper aims to explore the issues to be faced by researchers when developing a guiding framework for measuring the costs of green consideration, providing initial clues and information on how to possibly develop such framework in the future. Thus, this paper will address the following research question:

"*How can we measure the costs of including green criteria throughout the public tendering process?"*

The paper is divided as follows: the next section provides a discussion of the rationale behind this paper's methodology, as well as a description of the practicalities involved with the collection of materials for the literature review. Section 4 will then present the findings of the literature review, with section 5 providing a practical perspective on the issues highlighted in section 4. Section 6 will provide concluding remarks along with limitations and suggestions for future research.

3. METHODOLOGY

3.1 The Need For Exploration

While an empirically proven framework would provide a more valuable and practical guidance to the public procurement practitioners willing to implement green criteria at the various stages of the tendering process, "current discussion of the direct impacts of GPP must focus on setting out a qualitative framework for evaluation" (Marron, 2003, p.80). Despite the fact that exploratory studies "seldom provide satisfactory answers" (Babbie, 2010, p.92), they are valuable research tools for providing better understanding of new topics and their research feasibility (Babbie, 2010).

According to Babbie (2010), exploratory research is typically done for three purposes: to satisfy researchers curiosity, to test the feasibility of a more extensive research undertaking or to develop possible methodologies to be implemented in such future studies. As the aim of this paper is akin to all three of this primary purposes, an exploratory research design is the most appropriate for answering the aforementioned research question. Exploratory research is a secondary research approach, one in which hitherto published literature is analysed. Therefore, this paper will use current literature about green public procurement to analyse and discuss the relative possibilities and constraints of adopting green criteria at each step of the public tendering process.

3.1 The Materials Collection Process

For the purpose of obtaining relevant published literature on the topic of green public procurement, and more specifically its tendering process, the online abstract and indexing database Scopus was used, where a wide range of peer reviewed scientific materials are available. In order to retrieve a restricted number of valuable research papers, the following keywords were used to search the database, each relating to a different element of this paper's research question.

The first keyword included related to the activity performed, that is, the act of procuring products and services, whereby the keyword 'procurement' was used, with possible synonyms including 'purchasing' and 'buying'; the various alternatives were preceded by the logical operator *or*. *Figure #1* shows the different terms used to narrow down the list of possible literature sources and their preceding logical operators.

The second keyword, linked to the previous search term by the logical operator *and*, referred to the chief characteristic of the activity performed whereby the adjective 'green' was used as a keyword, allowing 'sustainable', 'ethical', 'environmental' and 'responsible' as alternative search terms; alternatives were, as above, preceded by the logical operator *or*.

The third search term, again preceded by the logical operator *and*, related to public sphere, or context, of this research paper, whereby the keyword 'public' was implemented together with the synonym 'governmental'.

Moreover, to further concentrate the results on the matter at hand, the search term 'cost' was adopted. As depicted in *figure #1,* the search words used were to be linked to either the literature's title, abstract or keywords.

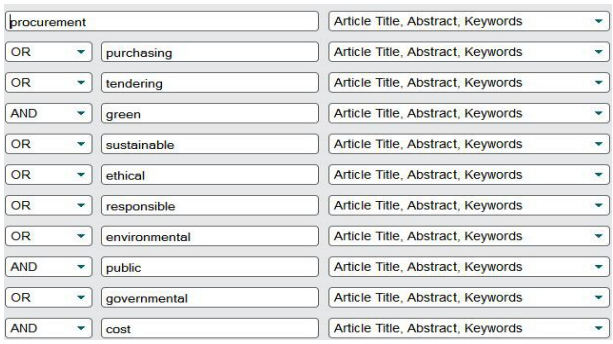

Figure #1

By using the criteria shown in *figure #1*, the query returned a total of 148 documents. In order to increase the relevance, a time frame was chosen: articles older than 20 years would be excluded from the list. Implementing this temporal refinement lead to a list of 135 documents, which was further narrowed by excluding book chapters and notes; net of these search criteria, a total of 128 documents were assessed upon the content of their abstract. Only articles which were deemed to be relevant to the present research question were then selected and used for the development of this research paper, resulting in a strong list of 23 peer reviewed articles. On top of these, a number of other materials such as textbooks and EU publications have been used for the writing of this research paper.

4. THEORETICAL ANALYSIS & LITERATURE REVIEW

This section will first suggest a possible framework for the assessment of the costs of including green criteria within the public tendering process, and then present the findings of the literature review.

4.1 Alternative Criteria

In order to measure the costs originating from the adoption of green criteria throughout the public tendering process, it is crucial to determine which green criteria is adopted: this is the the first and foremost driver of the costs of green criteria incorporation. By choosing different criteria, suppliers and their bids will receive different scores throughout the tender evaluation process, ultimately affecting the contracting choice.

More specifically, how can we measure the trade-offs between any green criteria and its alternatives, or any green criteria and its non-utilization? Each green criteria included in the tendering process should thus be assessed in light of the alternative green criteria available to the procurement professionals, with the assessment being made on a number of dimensions. What are these dimensions? This will be discussed in the following section.

4.2 Comparison Lenses

The current literature does not provide a definite answer regarding the best way to measure trade-off costs in green criteria selection. However, taking a more overarching approach, a number of lenses may be used as guidelines.

One such dimension, which could be considered to be the easiest due to its immediate impact on the financial costs of the procurement operation, is the price per unit difference; often choosing greener alternatives often brings about increased short term costs (Day, 2005). Similarly, another dimension could be represented by the difference in technical product quality, which is often deemed to be of poorer for greener products (Figge & Hahn, 2004). Qualitative variables can take many different forms, some of which can be more easily measurable than others. Differences in qualitative variables may lead to financial consequences to the buyer which, if calculable, should be included in the assessment of the costs of choosing one green criteria over its possible substitutes.

A third dimension on which to compare different green criteria decisions could consist in taking a life-cycle cost (LCC) approach, which involves "considering all the costs that will be incurred during the lifetime of the product, work or service" (EU Buying Green, 2011, p.42). This is relevant because there may be consistent differences in terms of utilization and disposal costs. However, if the LCC of a product is to be considered in the calculation of the opportunity costs of choosing any green criteria over other possibilities, then questions arise regarding which variables should be included in its calculation, and how precise can variable estimates be. This may be far from easy and is often seen as a tough challenge for companies with highly diverse product portfolios (O'Rourke, 2014).

As a fourth dimension, externalities can be comprehended in the comparative assessment of various green criteria. Expanding LCC analyses to include the impacts of the product or service at hand on entities outside the sole value chain has been defined as whole-life costing (WLC) (EU Buying Green, 2011). However, the measurement of externalities is really complicated, and tools are insofar insufficient for thorough WLC assessments (Humphreys et al., 2003; O'Rourke, 2014; Koomey & Krause, 1997).

An important issue regarding the last two comparative dimensions refers to the question of 'by whom' are these costs actually incurred. In fact, although there may be some internal contrasts between departments, the price and quality differences can be easily be assigned to the buying organization. However, deciding who is incurring the qualitative differences in terms of LCC or WLC is not as easy, as externalities affect a widespread range of socio-economic entities. Section 5.1 below will discuss the practicalities of making green criteria choices at the product specification stage and the relative costs thereof.

4.3 The Public Tendering Process

As the criteria available to procurement professionals vary depending on the stage of the tendering process, an introductory review of the process as implemented by public procurers in EU countries is hereby presented.

4.3.1 The Product Specification Stage

The product specification stage is the first stage of the tendering process. In terms of procurement process, it follows the need recognition phase in which internal stakeholders require the procurement department to purchase a certain good or service, the contract subject (ICLEI, 2007). At this stage, the contracting agent must transform the contract subject into measurable product/service specifications to be shared with potential bidders through the tender documents. These specifications are must-have characteristics that cannot be bypassed: suppliers whose offers do not comply with all of them are automatically excluded from the tender. Because of its primal role in directing the procurement process, setting these initial parameters is of key importance and special attention must be paid to the correct translation of the problem/need into suitable product features.

The Green Procurement Handbook (2011) of the European Union directly tackles the issue of how to implement green criteria within the specification of products, services or works. However, before discussing the various methodologies for doing so, it must be noted that it is crucial that the contracting agent performs ex-ante analyses of the possible environmental risks related to the product or service in question in terms of, for example, sustainability of product materials and production processes, energy and water consumptions, product life-spans or materials recyclability.

Having a grip around the potential environmental risks, the contractor is able to turn the environmental demands into specifications. There are two main ways in which European public entities can do so: through technical specifications or through functional specifications, with the use of ecolabels striking a balance between the two (EU Buying Green, 2011). Measureable technical specifications, which may be defined in terms of unambiguous, explicit and widely agreed common industry standards, are lists of simple, straightforward characteristics that the product or service must have (Monzka, 2009). Although rather inflexible, such specifications will bring about consistent bids that can then be evaluated on fewer dimensions. However, in order to ensure the cost-effectiveness and overall value of the specifications required, the buyer must have thorough knowledge of both the problem and the available market solutions.

Functional specifications are on the other hand more flexible, and leave room for supplier creativity and innovativeness (Day, 2005). Here, instead of asking for a very specific characteristic of the product/service, the contractor stresses the needed performance outcome; suppliers can then make different suggestions regarding the best way to address and solve the problem. Bids received using this type of specification methodology may be more complicated to assess due to the diversity of solutions received, and careful attention must be paid in devising fair and transparent assessment criteria, but it may bring about valuable cost-effective solutions which the buyer did not think of himself, perhaps due to low problem comprehension (Monzka, 2009; EU Buying Green, 2011). A further benefit of adopting performance-based product specifications is that it will challenge the market to come up with more innovative solutions, thereby fostering research and development (EU Buying Green, 2011).

Ecolabels provide procurement professionals with the possibility to implement both technical and functional criteria at the same time. They 'set out the environmental requirements which must be met by products or services in order to carry the label' (EU Buying Green, 2011, p.13), and are meant to simplify the work of procurers by referring to the scrutinizing activities of external bodies. According to EU law, public procurement entities cannot require a specific ecolabel in their product/service requirements, whereby whenever reference is made to a certain label, 'or equivalent' must be added (EU Directive 2014/24/EU, 2014). Although these specification

methods may be used independently, most tendering processes adopt, along with ecolabels, a mix of the two.

4.3.2 The Supplier Qualification Stage

This stage serves to analyse whether bidders have the capacity to perform the contract they are tendering for (ICLEI, 2007). In terms of green criteria, it gives the buyer the possibility to award the contract to companies which are deemed to be more sustainable, that is, that have greener organizational processes. The bidders who fail to reach a certain sustainability threshold, or standard, are dropped from the list of possible contract winners.

Procurers may implement three types of supplier selection criteria: exclusion criteria, technical capacity criteria and financial criteria; the former two are eligible for implementing green criteria (ICLEI, 2007).

"Exclusion criteria deal with circumstances in which an operator can find itself, that normally cause contracting authorities not to do any business with it" (EU Buying Green, 2011). The EU procurement directives provide an extensive list of cases where the contracting authority may exclude tenderers from participating; the most common reasons tend to be financial instability (bankruptcy), misconduct towards the treasury and other institutions (failed to pay taxes, corruption or similar issues) or professional misconduct, the latter including environmental misconduct. In case of serious criminal offences, the buyers is forced to exclude the bidder (EU Buying Green, 2011).

The technical capacity criteria address the bidder's capacity to fully perform the contract, and it usually comprehends company features such as previous experience, plant capacity or similar characteristics. Regarding the green aspect, it is possible to require certain experience with green projects, or the utilization of environmental management systems.

While information pertaining to the excludability criteria of companies should be obtained via thorough supplier scanning, technical capacity criteria should be obtained through a mix of supplier research and bidder-provided information; more specifically, bidders must be able to provide proof regarding their ability to fulfil all clauses of the contract (ICLEI, 2007).

4.3.3 The Award Criteria Stage

"At the award stage, the contracting authority evaluates the quality of the tenders and compares costs" (EU Buying Green, 2011). Here, only the bids received from suppliers that fulfil the technical and environmental criteria are considered. Setting green criteria at the award stage is useful when the buyer is not completely sure about the market and its offerings, whereby instead of setting high green standards in the previous stages of the procurement process, and thereby incurring the risk of eliminating possible valuable tenderers, the buyer uses green criteria as preference indicators that can be compared against each other at this last stage of the procurement process.

Within the EU, authority contractors can award the contract based upon two different key methods: lowest price and economically most advantageous tender (EMAT). The first method is straightforward, with the winning bid being the one offering the lowest price. The EMAT on the other hand is more complicated, but enables procurers to implement further green criteria still. Whatever the choice of the public authority, the methodology to be used in awarding the contract must be specified ex-ante to all participating tenderers. Within the EMAT principle, there are three key approaches to measuring criteria scores, each of which is briefly described below.

4.3.3.1 Quality-only scoring

In a 'beauty contest' the winning bid will be the one offering the highest quality per given unit price (Bergman & Lundberg, 2013). After a base price per unit is set, a combination of quality measures calculated using a weighted factor score (WFS) methodology will determine the winning bid: the bid with the highest overall WFS will win the contract. Since public administrations do not have access to unlimited funds, such method to award contract is unlikely to be popular among public procurers. However, in some cases where qualitative excellence on some green criteria is of key importance to overall product value or where the product is earmarked to a specific budget, beauty contests can provide the best outcomes for the public agency. As will be illustrated below, a key issue here is represented by the allocation of relative weights over the different green criteria; the procurer must in fact be knowledgeable about his preference and relative importance of various quality criteria, possibly taking into consideration the marginal cost curves of each green criterion.

4.3.3.2 Price-to-quality scoring

Adopting a 'price-to-quality' methodology means making the bid's price one of the multiple quality criteria, all of which are then given weighted scores that are combined to calculate overall bid scores. These bid scores are then ranked against each other and the one best overall quality score (which comprises price too) is the winning bid (Bergman & Lundberg, 2013). Bergman & Lundberg (2013) find this award methodology to be the most frequently used by public purchasers in Sweden municipalities.

4.3.3.4 Quality-to-price scoring

In a 'quality-to-price' approach the qualitative criteria, such as green and sustainable criteria, are given scores and then transformed in a currency value which can be added or subtracted from the offer's price (Bergman & Lundberg, 2013). This last EMAT methodology, considered by Bergman & Lundberg (2013) as the most efficient methodology for achieving buyer goals, is similar to the price-to-quality methodology in that price is one of the variables considered in the WFS analysis, however here it is the green criteria that is transformed into currency. One major benefit of this method is the direct link between the buyer's green budget and the outcomes of the tender award. In fact, the first step of the quality-to-price scoring is to decide a monetary value for the quality of the procured product or service; more specifically, public procurers must set a financial amount to be linked to the relative quality of the bids, which is then used to adjust the original bid price. This amount is what Dimitri et al. (2006) refer as the 'buyer's monetary equivalent' (BME). This is not an easy decision, one that is likely to require a great deal of analysis, negotiation and managerial decision making.

5. PRACTICAL ISSUES

In order to discuss the practicalities of incorporating green criteria at the product specification stage, we will use the fictional case of a Dutch municipality, 'Greenveld', who is about to improve its public transportation service through the acquisition of 10 new buses.

Please note that any green criterion used in the sequent discussions were chosen subjectively by the author; providing a list of valuable green criteria is beyond the purposes of this paper (for literature addressing green criteria selections please refer to: Galankashi et al., 2015; Banaeian et al., 2015; Ashemi et al., 2014; Humphreys et al., 2013).

5.1 The Product Specification Stage

Since Greenveld's administration explicitly requested for 'environmentally friendly' buses, the procurement department prepares a request for quotation (RFQ) with a number of green product requirements. Greenveld's procurement department decides to include the following green criterion into the RFQ: the buses must be fully electric.

Table #1 below shows the the simplified offers from potential bidders in the area, including the price per bus. In order to discuss the cost of green consideration, the offer of a non-electric buses provider is included as well, although it wouldn't even be considered as it fails to fulfil the minimum (specification) criteria.

Table #1

BID	PRICE (K)	TYRE USE	FUEL TYPE
A	50	B	Electric
B	60	B+	Electric
C	30	A+	Diesel

Clearly, the implementation of green criteria at this first stage of the procurement process brought about a change in the final ranking of suppliers. Before considering any green product specification, company's C bid was the cheapest, costing Greenveld's administration only 30.000€ per bus. However, since electric buses only are to be admitted to the subsequent phases of the tender, such low cost opportunity has been lost. Is the difference between the price of the best 'green' bid and that of the best non-green bid, namely 50k-30k = 20k, the cost of requiring electric buses?

Similarly, we may measure the opportunity cost of implementing any green criterion through the difference between the winning bid and another upon other qualitative dimensions. For example, using Greenveld's example shown in *table #1*, supplier C was offering a very green product in terms of tyre consumption, but could not participate to the tender due to the fuel source of its tendered buses. Should the difference between the winning bid and the losing bids on the dimensions of bus tyre-friendliness be included? And how can these differences be measured?

Tyre-friendliness is, on the other hand, just one of the many variables which may compose a bus' life-cycle cost. LCC is, according to the discussion set in section 4, the third dimension upon which it may be possible to measure the opportunity cost of any green criterion choice. In fact, if other variables such as fuel costs or CO2 emissions may be included, then bid A (or B) may prove to be the cheapest afterall.

although LCC represents an improvement over any single qualitative measure for measuring costs, the fourth dimension for assessing costs as discussed in section 4, namely whole-life costing, is even more comprehensive and may thus represent a more valuable approach to the calculation of opportunity costs. For example, according to LCC analyses the choice of requesting electric engines as a product specification was justified in light of the cheaper running costs over buses' lifetimes, as electricity was deemed to be cheaper and greener compared to petrol-based fuel sources. However, taking a WLC approach, it may be found that the energy supplying the electric buses was produced through the burning of coal, which is very harmful in terms of CO2 emissions, more than what the diesel engines of the buses might have done.

5.2 The Supplier Qualification Stage

Having eliminated bids containing non-electric buses, Greenveld's procurement department is now selecting offers based upon the bidder's own environmental friendliness in terms of operations. In order to compare the various companies, Greenveld's administration decides to require a certain level of environmental management system (EMS), namely ISO 14000; any company who does not have such an EMS or equivalent in place will be discarded from the list of potential contract winners. This is an example of implementing a green technical capacity supplier qualifier, and is depicted in *table #2*.

Table #2

BID	PRICE (K)	kWh/Km	ISO 14000
A	50	140	N
B	60	130	Y
C	55	150	Y

As much as in part 5.1 with the implementation of green product requirements, setting green supplier qualifications will eliminate potentially valuable suppliers and their offers. As shown in *Table #2*, bidder A, who offered the best unit price, does not operate under ISO 14000's (or equivalent) guidelines, whereby it cannot be considered further by Greenveld's procurement. What is the cost the procurer of eliminating supplier A to the procurer? Section 4 highlighted four lenses through which it possible to analyse the opportunity cost of any green criteria.

First is the obvious and straightforward unit price difference, which in Greenveld's case would be 55-50=5k. Secondly, head-to-head comparisons can be made on qualitative dimensions too. Using the example provided in *table #2* still, the discarded supplier A also provided a very energy friendly bus, one which would consume less battery than the buses of the other tenderers. So, another possible way to measure the cost of green integration would be to assess the difference in quality between the bids which are considered at a later stage and those who are not. Despite the possibility of measuring these costs independently, it seems more valuable to consider these opportunity costs simultaneously, perhaps by assigning a monetary value to the different qualitative criteria.

However, as previously discussed in section 4, other more complex but comprehensive methodologies are available for examining the cost arising from the implementation of one green criteria over another: the life-cycle costing and the whole-life costing. LCC considers all the sources of cost related to a product' production, consumption and disposal, while WLC extends the LCC model to include externalities. Although supplier qualification green criteria are, by nature, what Lloyd (1994) calls supplier-related environmental criteria, their influence on the tendering process extends to product-related environmental criteria. Differences in LCC or WLC may thus be used to measure the cost of integrating a certain green criteria in the tendering process.

5.3 The Award Stage

This section will address the question of what is the opportunity cost of implementing a certain green criterion in the supplier selection process through one of the three EMAT methodologies described in section 4.3.

5.3.1 *Quality-only scoring*

The implementation of a beauty-contest is relatively easy. As stated earlier, the contracting agent sets a maximum price per unit, or price ceiling, the entity of which will be heavily influenced by the competitiveness of the market and the marginal production cost curve of the potential suppliers. Next, the procurer must devise the combination of qualitative criteria that it wants to implement at the award stage, assigning each a weighted score and eventually sub-scores; these include green criteria too. Each bid is then assessed against these pre-selected criteria and an overall score is calculated. The bid that provides the buyer with the highest overall quality is the winner of the contract. By using the case of Greenveld's electric buses procurement, *table #3* shows the implementation of a 'beauty contest' in practice.

Table #3

BID	kWh/Km	kWh/Km Score	Handling	Handling Score	Total Score	Bid Rank
A	140	80*(130/140) = 74	9	20*(9/9) = 20	74 + 20 = 94	2
B	130	80*(130/130) = 80	7	20*(7/9) = 16	80 + 16 = 96	1
C	150	80*(130/150) = 69	7	20*(7/9) = 16	69 + 16 = 85	3

The mathematics adopted in *table #3* above are just one of many possibilities. There are multiple ways in which public procurers can calculate the value of any offer using multi-criteria and WFS analyses, but due to the limited scope of this paper, they won't be discussed here; for a more thorough discussion of the implications of the various methodologies and functions please refer to Telgen & Schotanus (2010) and Bergman & Lundberg (2013). However, it must be noted that adopting different formulas leads to different results, thereby affecting the ultimate result of the awarding process.

On top of these eventual price premiums, another source of cost may lie in the forgone opportunity to get the best price/quality combination. For example, it may well be that a supplier is able to provide a product which is as much as 20% higher in quality with as little as 10% of a price increase, but due to the set price ceiling, this supplier is unable to participate to the tender and the buyer loses a potentially valuable product that had a better quality/price ratio. This is shown in *figure #2* below.

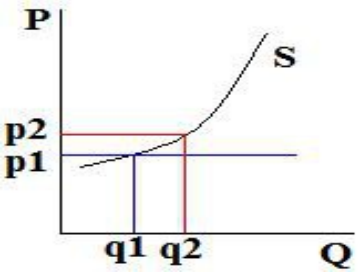

Figure #2

Due to the price ceiling set at *p1*, the supplier in question is only able to participate to the tender with a product with a quality of *q1*, while if he were allowed to participate with a product priced *p2*, he would have been able to provide a product of quality *q2*. As the difference between *q2* and *q1* is greater than the difference between *p2* and *p1*, the buyer has lost a potentially superior product by using quality-only scoring methods. It is not clear whether these missed opportunities should be linked to the cost of green criteria implementation, but they certainly add to the complexity of the endeavour.

On top of the costs arising from the inner workings of the awarding procedure based upon a mix of quality-only criteria, the choice of various qualitative criteria leads to various opportunity costs. More specifically, the various criteria can be assessed on the grounds of life-cycle costing, whole-life costing as to include externalities, or more simply the qualitative and financial differences that arise with the different winning bids.

5.3.2 *Price-to-quality scoring*

Here the bid price is treated like a quality variable, to which a certain weight is given. Through a WFS analysis, the combination of all scores on all criteria will give a final bid score that can be rank-ordered against the other bids. So despite the similar use of WFS, this EMAT awarding methodology differs from the previous in that it comprises price as a variable of the bid analysis. As much as with a quality-only methodology however, there are many different ways in which procurers can perform a WFS analysis in a price-to-quality methodology, all of which deliver different results and relative bid ranks.

Table #4

Bid	Price (k)	Price Score	kWh/100Km	kWh/100Km Score	Tot Score	Bid Rank
A	55	80*(50/50) = 80	155	20*(130/145) = 18	80+18 = 98	1
B	65	80*(50/65) = 62	130	20*(130/130) = 20	62+20 = 82	3
C	60	80*(50/60) = 67	150	20*(130/150) = 17	67+17 = 84	2

In the simple example above, Greenveld's administration decided to award the contract to company A due its better overall weighted factor score, product of a stressed importance of the price variable over the green variable. What are the possible ways which enable researchers to measure the costs relative to the implementation of these green criteria choices?

Here too are the dimensions discussed in section 4 valuable lenses through which to analyse the relative costs of choosing a determined mix of green criteria. These lenses refer to the short-time effects on the winning bid's price and quality, as well as to more long-term considerations affecting both the value chain or the socio-economic community at large.

5.3.3 *Quality-to-price*

As much as in the previous EMAT methodologies, a WFS analysis is used: the score obtained on a certain variable is then put in relation to the BME set by the procurer to be available for greener procurement. In order to show this in practice, the fictional case study of Greenveld's procurement of electric buses is used.

First of all, the Greenveld administration must decide how much money it wants to spend on the resource efficiency of its electric buses, as measured by the consumption of kilowatts hour per kilometre. Greenveld's procurement professionals, in consultation with accountant and higher officials, decide to assign a discount value of 0.5k for each kWh/Km lower than 160, for a maximum of 20k (below 120kWh/km no further incentives are given).

Table #5

Bid	Price (k)	kWh/100Km	kWh/100Km Score	kWh/100Km Value	Adjusted Price	Ranking
A	55	155	160-155 = 5	5*0.5 = 2.5k	55 - 2.5 = 52.5k	3
B	65	130	160-130 = 30	30*0.5 = 15k	65 - 15 = 50k	1
C	60	150	160-150 = 10	10*0.5 = 5k	60 - 10 = 50k	1

The monetary values of the efficiency scores of the different bids are then subtracted from the bid original price, thereby producing an overall adjusted bid price. *Table #5* shows this in practice.

In line with the WFS analyses of the other possible EMAT awarding methodologies, here too can different functions be devised for the calculation of scores, and for simplicity's sake only one qualitative variable has been taken into account. However, it would be very simple to extend the model as to include more variables and sub-variables (Bergman & Lundberg, 2013).

There are various ways in which it possible to consider the cost of including green criteria in the award phase. As much as in the other stages and in the other EMAT methodologies, the difference between the price of the winning bid versus the price of the winning bid were green criteria not included can be deemed to be one straightforward way to assess the cost of GPP; in *table #5*'s example it would be 60-55 = 5k. This would be the first dimension available to compare the cost of different green criteria.

As previously discussed however, what this technique enjoys in ease, lacks in completeness as it completely ignores the potential long-term costs to both the organization, the value chain or other third parties. In order to include these, life-cycle costing techniques or, better yet, whole-life costing techniques provide other means by which to assess the relative opportunity cost of any mix of integrated green criteria.

Another way to assess the costs of integrating green criteria using quality-to-price methodologies, one which is more specific to the methodology itself, is proxying it through the BME, the amount of money the buyer is willing to invest on product/service sustainability. While measuring the cost of green consideration through the BME budget may represent a valid choice, a further methodology that could be used is the BME% which is actually used to detract points (the price discount) from a bid's price, which is not always the same as the full BME budget.

6. DISCUSSION

In this section, the key results of the literature review will be discussed as to answer the research question presented in section 2, namely "*How can we measure the costs of including green criteria throughout the public tendering process?"*.

As pointed out in sections 4 and 5 of this paper, the issues surrounding the measurement of the costs of implementing green criteria at the various stages of the procurement process are multiple and diversified in nature. One of the foremost challenges to be overcome are methodological: present day tools for the measurement of externalities are not comprehensive enough (O'Rourke, 2014); in order to give a more precise estimate of the effects of including green criteria in the tendering process, researchers must be able to assess their medium and long-term effect on a wide range of micro and macro entities.

As these tools are lacking, any conclusion regarding the effects of green criteria implementation within the public procurement process can only be limited to short-term financial measures. However, a number of influential institutions, such as the EU, are increasingly stressing the importance of taking broader perspectives when engaging in public purchasing (Day, 2005). More specifically, procurers are increasingly expected to include life cycle cost assessments when awarding contracts. This is a step in the right direction, although in order to measure the cost of green practices a more general and overarching approach is required, one which goes beyond the single product/service contract as to comprehend positive and negative externalities on a wide range of transaction stakeholders. Whole-life costing methodologies may provide the necessary tools for doing so in the near future.

Another hurdle in the creation of a framework for assessing the costs of green consideration stems from the multitudinous set of green criteria available. In fact, at various points in this paper, the trade-offs to be made between the various green criteria available to the procurement professionals have been mentioned as key sources of costs. It is worthy to stress that the measurement of the opportunity costs arising between various green criteria alternatives is an important methodology for measuring the cost of green consideration. Relatedly, another complication is caused by the massive increase in eco-labels available to businesses and procurement practitioners. Different labels will provide different analyses, and comparing green performances and their relative costs can be quite a headache for public agencies, let alone for researchers willing to create a framework for measuring costs.

A further source of concerns stems from the diverse set of scoring methods available to public procurement practitioners. Especially during the award stage, addressed in section 5.3, public purchasers have a wide range of scoring methodologies available for assessing the relative strengths of the proposed bids. The combination of these various awarding techniques and scoring methodologies leads to uneven procedures between tenders, enhancing the difficulties to be faced in the development of an overarching framework for systematic measurement.

It is the responsibility of the public organization, as the contracting authority, to purchase goods and services in a way that taxpayers get the best value for money while acting fairly towards the principles of the internal market. Best value for money does not mean to engage in contracts based on price only, but to consider qualitative criteria which may impact the ultimate value of the product service over the long term. If green procurement practices are to become popular among practitioners and professionals, in public and private sectors alike, then we must develop a consistent and thorough framework for assessing the costs of these practices.

7. LIMITATIONS AND CONCLUSION

This exploratory paper has, by means of a literature review and of abstract analysis, highlighted some of the possible ways in which it is possible to measure the costs relating the integration of green criteria into the public tendering process. Latest academic literature and legal documents published by an array of governmental organization have been used to shed some light on the public procurement process and its the activities concerned with the selection of suppliers.

This paper finds that developing a model the measurement of the costs related to the implementation of green criteria in the tendering process is problematic due the great variety of green qualitative criteria available to procurers professionals; the great number of qualitative variable combinations, as well as the number of lenses through which to the relative opportunity costs, makes it very difficult to assess tenders uniformly. Although ecolabelling may provide a possible solution to this problem, bringing together different product specifications and production processes, there are many different ecolabels available whereby their comparison can still be problematic.

Furthermore, researchers will have to deal with the wide array of variables influencing the very concept of cost: unit prices are just the basis of a product choice's cost, with production, consumption and disposal costs bearing an important impact on the overall cost calculation. It is therefore very important to address life cycle-costing when developing an overarching framework for the measurement of the costs of green consideration in public procurement.

This paper also finds that externalities play a major role in defining the real value of any product choice, especially when taking a public perspective to procurement decisions. It is therefore advised to implement thorough whole-life cost assessments when attempting to measure the cost of green consideration in the future, with the inclusion of as many entities and affected parties as possible in the cost calculations.

This research article suffers from a number of limitations, most of which are endogenous to its exploratory nature. The findings here presented cannot provide conclusive recommendations regarding the costs of green criteria inclusion in the public tendering process, as the discussions and the examples are purely theoretical; any conclusion and/or suggestion is very subjective in nature.

In order to strengthen external validity, future research should adopt a more empirical approach to the issue and perhaps gather data regarding green criteria implementation in supplier selection decisions and their medium to long-term impacts. In this respect, longitudinal studies may provide valuable insights. A number of other questions arise when analysing EMAT award methods for the implementation of green criteria. For example, are different methodologies to be preferred based upon the nature of the product or service at hand? Should quality dimensions with diminishing returns be handled the same way as quality dimensions with constant marginal benefits? And does quality measurement play an important role in making certain scoring methodologies superior to others? The answers to these questions, as well as to others presented earlier in the paper, may have an important impact on the future development of a framework for the measurement of green tendering costs.

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