SUSTAINABILITY AS AN INNOVATION IN PUBLIC PROCUREMENT. THE CASE OF SUSTAINABLE CONSTRUCTION IN GREECE

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ABSTRACT

Project performance evaluation methods have been widely used in construction mainly in the construction stage. A potential improvement can be obtained through the use of performance indicators (PIs) during the procurement process. In this paper a methodology to diagnose, evaluate and improve the procurement process for construction projects based on the Balanced Scorecard (BSC) was developed and applied in selected projects. Recent Greek legislation in procurement and its application to construction projects is also examined. The results derived from selected projects in Greece show that the main problem of procurement is related to the waste of processes and the lack of quality specifications of projects. The use of PIs for the procurement process is recommended for continuous improvement and visualization of the project.

1. INTRODUCTION

In the last decade an expressed trend towards developing sustainable construction practices was noticed. A new term 'sustainable construction' with its roots in the broader concept of 'sustainable development' has been coined. According to the definition suggested by the World Commission on Environment and Development (WCED) sustainability meets human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations (WCED, 1987).

In terms of sustainable construction procurement, the goal is to achieve both a high quality of construction and performance of

buildings operation. To the best of the authors' knowledge there is no single definition of sustainable procurement and its applications vary across organisational hierarchy and sector. Sustainable procurement is rather an investment process associated with public and private sectors. Organisations and enterprises that apply sustainable procurement aim to meet their needs for both goods, and services on cost-benefit analysis taking also into account positive externalities. To achieve these goals they have to incorporate extrinsic cost into decision making frameworks alongside with the conventional procurement criteria of price and quality. These considerations are usually classified into: environmental, economic and social criteria (also known as the "triple baseline").

The role of procurement in the construction industry in achieving sustainability is fundamental given that the industry's basic function is the manufacture, relocation, and assembly of materials into structures. In construction performance based standards and performance tests are tools in this context. Performance measurement (i.e. the activity of measuring performance using performance indicators (PIs); Lohman et al., 2004) is used as a tool for monitoring, measuring and evaluating performance through a set of PIs (Kagioglou, 2001) or by employing the Balanced Scorecard (BSC) framework (Kaplan and Norton, 1992).

In Greece legal and institutional frameworks set the basic conditions for the way the sustainable procurement may be undertaken procedurally, the results that can be expected, and the potential efficiency gains that can be achieved. The professionalism of public purchasers in managing the procurement process and taking advantage of new trends towards green products is therefore decisive. Since sustainable construction ensures best value for money through an open and non-discriminatory procurement regime, the Greek authorities (Ministries, municipalities etc) sometimes seek to achieve other domestic policy goals, such as promotion of sustainable products. Recent legislation now contains detailed procedural obligations with which procuring entities ensure consideration of sustainability issues.

Award criteria for tenders may include except for cost, also quality and performance, time, ingenuity and environmental effects. Positive externalities can also be taken into account depending on the availability of data and how clearly these externalities have been identified as regards the subject of the contract under consideration. It

is believed that risk assessments associated in most of the projects can help to establish the key externalities from procurement, such as suppliers' compliance with legislation and in particular, on health and safety.

There is a bulk of the related literature in construction project performance management approaches that used to identify the causal factors of performance. For a review of the literature on performance management in various industries with the aim of transferring best practice into construction see Kagioglou (2001). However, there is limited research on sustainable procurement practices used by construction companies. This paper is an extension of the sustainability balanced scorecard (SBSC) as it is developed to include sustainable public procurement criteria derived by means of the Delphi method. In order to study the status and potential of the application of sustainable procurement in construction procurement, in this paper we develop a tool based on BSC and sustainability principles to effectively monitor and control project activities for the purpose of improving project results. A research study using questionnaires was conducted from municipality projects such as water quality and infrastructure reducing air pollution, implementing efficient waste management systems, rehabilitation of existing district heating units' works, energy systems such as Photovoltaic's lighting and related services in Greece. For this study we proposed a SBSC as an extension of traditional BSC as such a tool by adding a sustainability perspective (Lohman et al., 2004).

The paper is organised as follows. First the BSC as a tool of measuring the performance at the firm level is described and its possible integration with the Delphi method to measure sustainable procurement. After that the methodology of selecting corresponding criteria based upon the Delphi method is analyzed. The questionnaire survey as applied to the Greece's Sustainable procurement in the construction sector is presented, followed by the study results and conclusions of the study.

1.1 Balanced scorecard (BSC)

Since the early 1990s when Kaplan and Norton (1992) developed the BSC, there has been a growing bulk of the relevant literature on different applications of the BSC in many types of industries both in the US and internationally. In the past, performance management systems have focused on measurements and indicators alone. The BSC, in contrast to other approaches, links strategy

performance and goes beyond the traditional financial metrics to determine whether or not an organization is performing well. According to the BSC the organization's strategies and their execution are among the key factors in performance improvement.

BSC employed by construction managers can offer them a tool for performance improvement by allowing quickly building and providing customized dashboards. Moreover, dashboards on metrics can provide a complete picture of all the information related to performance. BSC establishes a set of strategic performance metrics to support the organization, provides management with a detailed view of the procurement performance over a period of time, reviewing these metrics on a regular basis, allows identifying areas that may need improvement as well as the accomplishments of the organization towards procurement. The four perspectives used in this study are inspired by Norton and Kaplan‘s BSC namely the customer perspective, the learning and growth perspective the internal-business processes perspective and the sustainability perspective (Figure 1).

1.1.1 The learning and growth perspective

This perspective looks at the contribution of the project to the core competencies of the organization and to the organization's mission and strategic objectives. Candidate factors in this perspective could be the educational level of personnel.

1.1.2 The customer perspective

The customer perspective of our SBSC for construction projects looks at the project deliverables as well as stakeholder satisfaction with the final outcomes (e.g. service satisfaction and quality etc).

1.1.3 The internal-business processes perspective

The objective of the learning and growth perspective is to provide the infrastructure to enable the objectives of the other three perspectives of the conventional BSC. The measures that may include (e.g., labour productivity) are used to examine whether the project is a platform for growth, and look at the durability of its effects. Relevant internal-business processes perspective indicators could be average unit production time, working capital/sale, and capacity utilisation (Lee et al., 2008).

1.1.4 The sustainability perspective

The sustainability perspective may include candidate social PIs such as customer satisfaction, supplier satisfaction, community satisfaction, community contributions / and environmental impacts measures such key material usage per production unit, energy usage per production unit, water usage per production unit, emissions, effluent and waste per production unit, and industry specific factors such as lost time or injuries.

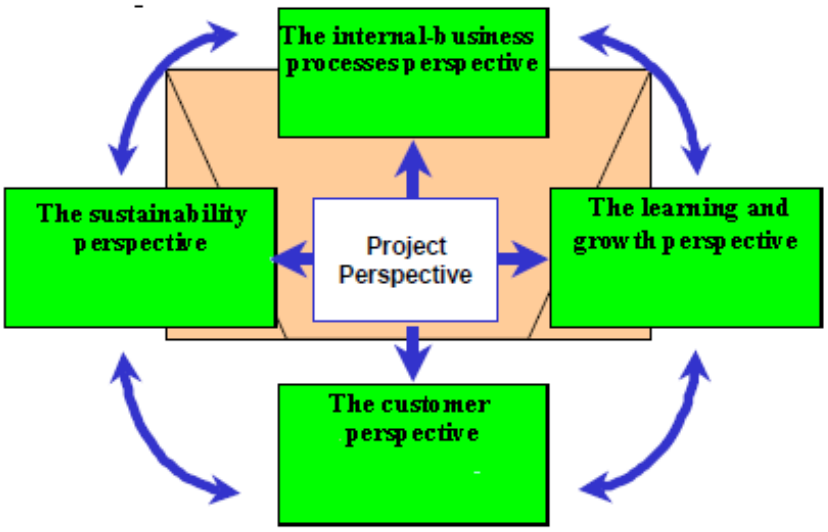

Figure 1. Project Performance (Sustainability Balanced scorecard)

2. METHODS

The original Delphi method has coined as a method by Norman Dalkey of the RAND Corporation in the 1950's (Dalkey & Helmer, 1963, p. 458) for a US sponsored military project. Rowe and Wright (1999) characterize the typical Delphi method by four key features:

1. Anonymity of participants that allows them to freely express their opinions. Decisions are evaluated on their merit, rather than who has proposed the idea.

2. Iteration, a procedure that allows the refinement of participant views from round to round.

3. Controlled feedback, a procedure that informs the panel members of the other members' perspectives, and provides the opportunity for all participants to clarify or change their views.

4. Aggregation of group response by means of statistical analysis that allows for a quantitative analysis and interpretation of data.

Rowe & Wright (1999) argue that only those studies that have the four above features should be classified as Delphi studies, while some other researchers (e.g. Adler & Ziglio, 1996; Delbeq et al., 1975; Linstone & Turloff, 1975) show that the technique can be effectively modified to meet the needs of a given study.

2.1 Typical Delphi Process

The Delphi process has been comprehensively reviewed elsewhere and so we present only a brief overview of how we have used the Delphi in our research. A brief overview of the Delphi method as used in this study is presented in figure 2. For review on the Delphi Process see Adler & Ziglio (1996), Delbeq et al. (1975), and Linstone & Turloff (1975).

The method is consisted of four steps (figure 2).

1) Preparation phase that is consisted of pilot studies, and literature review. Sometimes a Delphi pilot study is conducted to testing and adjusting the Delphi questionnaire, to improve comprehension, and to work out any procedural problems.

2) Research method that deals with the following steps:

2.1 Develop the research question

2.2. Design the research from a macro to a micro perspective. It is necessary to review different research methods (both qualitative and quantitative) and after considering the pros and cons of each, to select the most promising one(s) that help to answer the developed research question. Delphi method is selected when judgments of experts in a group decision making setting are wanted.

2.3 Research sample of experts. The selection of participants is a critical component of Delphi research since the method output is based upon their opinions (Ashton 1986; Bolger & Wright 1994; Parente et al., 1994). There are four requirements for participants' "expertise": i) knowledge and experience with the issues under investigation; ii) capacity and willingness to participate; iii) sufficient time to participate; and, iv) effective communication skills (Adler & Ziglio 1996).

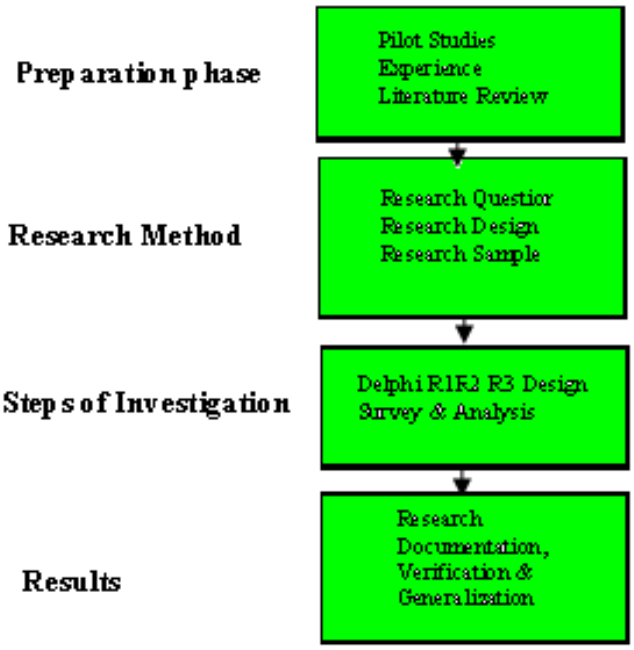

Figure 2. Three Round Delphi Process

3) Steps of investigation that includes the following:

3.1 Develop Delphi round one questionnaire. The development of the initial broad question is very important since if respondents do not understand the question, they may provide inappropriate answers and/or become frustrated (Delbeq et al., 1975). Sometimes, the purpose of the first round Delphi is to brainstorm (Schmidt, 1997).

3.2 Release and analyse round one questionnaire. The questionnaires are distributed to the Delphi participants, who complete and return them to the researcher. The results of round one from the completed and returned questionnaires are analysed. Reality maps (i.e. graphical representations of the key constructs under investigation) can also be developed and shared with the Delphi participants. These maps can improve understanding about the topic under investigation and facilitate the emergence the whole process (Lindstone & Turloff, 1975).

3.3 Develop round two questionnaire. The round one responses feed the round two questionnaire.

3.4 Release and analyse round two questionnaire. The round two questionnaire is released to the research participants and when

completed, returned for analysis. However, the participants are first given the opportunity to verify that the round one responses did indeed reflect their opinions and are given the opportunity to change or expand their round one responses as the other research participant's answers are shared with them. Ranking and rating the output of the first round is common (R. Schmidt, 1997). Continuous verification throughout the Delphi process is critical to improve the reliability of the results (Adler & Ziglio, 1996; Delbeq et al., 1975; Linstone & Turloff, 1975) and should be factored into the research design. Again, a similar process of analysis is often used in round two (Dietz, 1987).

3.5 Develop round three questionnaire. The round two responses feed the round three questionnaire. The questions this questionnaire have become more focused on the specifics of the research at each round.

3.6 Release and analyse round three questionnaire. This round of analysis is conducted following a similar process used to analyse the data in the previous rounds. Again, the participants have an opportunity to change their answers. The process stops if the research question is answered, i.e. consensus is reached.

4) Results; this phase is consisted of research documentation, verification, and generalization. The Delphi results are verified and the extent that the results can be generalized is also investigated.

2.2 Applications of the Delphi method

The are a lot of studies that have used the Delphi method, see Adler & Ziglio (1996), Linstone & Turloff (1975), and Rowe & Wright (1999) among others. While a three round Delphi is typical procedure, single and double round Delphi studies have also been conducted. The sample size varies in their studies from small sized (e.g. 4) to large sized (e.g. 171) sample of "experts".

2.3 Preparation of a Delphi study of the Greek construction industry

The key issues in preparing a Delphi study are the definition of experts and their selection, the number of rounds and the questionnaire structure (i.e. number of questions) in each study round (Manoliadis et al., 2006).

An expert may be defined as someone with special skills or knowledge evident through his or her leadership in professional organizations, or someone holding office in a professional organization,

a presenter at national conventions or someone who has published in recognized journals (Cabanis, 2002).

Once an expert panel has been identified, an additional problem is to maintain their input throughout the rounds of the study. The study is organized into a greater number of rounds in order to distil greater consensus of the participants and gain better forecasting accuracy. Moreover, the number of questions in each round is closely related to the time required from the participants to complete each round.

2.4 Experts selection

The following criteria were devised in order to identify eligible participants for the present Delphi study:
(1) Practitioners should have extensive working experience in the construction industry in Greece;
(2) Experts should be involved in the management of construction projects in Greece and
(3) Experts should have a detailed knowledge of the whole procurement process.
A list of the panel members and their type of occupation are shown in Table 1 (experts names and their organizations are not reported to respect their anonymity). Selected PIs are presented in Table 2.

2.5 Number of Rounds

The number of rounds depends upon the purpose of the research. Delbecq et al. (1975) suggest that a two or three iteration Delphi is sufficient for most research except for the cases where the sample is heterogeneous, and group consensus is desirable; then three or more rounds may be required.

2.6 Description of the adopted Delphi Method

The Delphi method adopted in this study consisted of the following two rounds. The first round questionnaire consisting of 7 factors was sent out in December 2009. The experts were asked to answer four questions (Table 3).

Experts	Number
Engineers	5

Industrial administration	1
Sail persons	2
Journalists	1
Total	9

Table 1 List of experts

In round two, the experts were provided with some modifications arrived at via the experts comments from the first round. They were given the numbers of response of each factor based on the scale of criticality again. To achieve consensus in the statements added by the panel during the first round, the experts were directed to review their rating again in terms of their criticality. The second questionnaire was sent in January 2010 and the questionnaires were collected by the end of February 2010. At this stage, most of the experts had reconsidered and made adjustments to their score.

2.7 Development of the questionnaire

The questionnaire refers to the PIs according to facts that have emerged as a result of the international and national construction industry's response to sustainability.

The final PIs selected for consideration are presented in Table 2. Experts were asked to answer the following questions:

Question 1: What is the most important PI in sustainable procurement in Greece?
Question 2: What is the contribution of the PI to sustainable procurement in Greece?
Question 3: To what extent will be the progress of the PI in the next coming decade?
Question 4: How the PIs are prioritized in accordance with achieving further sustainable procurement in Greece?

No	Performance indicators (PIs)
1	Reduction of waste
2	Customer satisfaction
3	Education of personnel

4	Capacity utilisation.
5	Service and quality
6	Client cooperation
7	Use of technology

Table 2 Performance indicators (PIs)

3. CASE STUDY

A methodology is proposed for measuring the performance of construction procurement. The performance measurement process adopts the BSC with the addition of a number of elements and perspectives. It rationalizes the relationships between performance measures and goals derived from strategy, so the impact of those measures on firms/organizations performance can be analyzed further to indicate potential areas for improvement. For the purposes of this study we have considered performance indicators for sustainability such as reduction of waste, customer satisfaction, capacity utilization service and quality, client cooperation and use of technology.

In Greece innovative environmental criteria are included in the public tender process for municipality construction projects, considering issues from conceptualisation to implementation. A total of 9 experts were asked to fill the questionnaire below in terms of the components of the SBSC. 26 questionnaires were returned. The relevant questionnaire's part was as follows:

Consider your measures and rate them as follows:
1) No value on this goal
2) Some help on this goal
3) Quite helpful on this goal
4) Valuable on this goal
5) Extremely valuable on this goal

Many researchers have identified factors affecting the project performance in construction using the Balanced Scorecard. Kagioglou (2001) presents a review of the literature on performance management and measurement in various industries with the aim of transferring best practice into construction. In Kagioglou (2001) a framework is

presented which ensures that effective strategies are deployed to form the performance management system that construction organizations can adopt.

4. RESULTS

The first round of the Delphi questionnaire was delivered to the panel experts. Table 3 shows the outcomes of participants' perceptions (mean values) in response to the survey questions of round one and their relative rank. As far as the first question is concerned (What is the most important PI in sustainable procurement in Greece?), reduction of waste ranked first followed by service and quality of the product/service. As for the answers to the second and third question (What is the contribution of the driver to sustainable construction in Greece? To what extent will be the progress of the driver in the next coming decade?) reduction of waste ranked first followed by customer satisfaction**.** Question four (How the PIs are prioritized in accordance with achieving further sustainable construction in Greece?) was answered in the following order: Reduction of waste ranked first followed by service and quality.

PIs	Question 1		Question 2		Question 3		Question 4	
	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1	4.67	1	3.89	1	3.78	1	3	1
2	3.67	6	3.33	2	3.44	2	3.22	2
3	3.56	7	2.67	6	3.44	2	4.33	5
4	4	4	2.56	7	3.44	2	5.33	7
5	4.33	2	3.22	3	2.67	4	3.33	3
6	3.78	5	3.11	4	2.44	5	5.11	6
7	4.22	3	2.89	5	3.11	3	3.67	4

Table 3. Round 1 of the Delphi study

Table 4 shows the outcomes of participants' perceptions (mean values) in response to the survey questions of round two and their relative rank. First question (What is the most important driver in sustainable construction in Greece?): a change was recorded in the ranking after the ninth factor of change. Second and third questions (What is the contribution of the driver to sustainable construction in Greece? To what extent will be the progress of the driver in the next

coming decade?): no change was recorded in the ranking while a slight difference was recorded to the mean values of grading the factors of change. Fourth question (How are the drivers prioritized in accordance with achieving further sustainable construction in Greece?): a change in the ranking between the fifth and the sixth performance indicator.

On the basis of the slight changes in the results of both initial rounds we concluded that consensus had been reached. A third round, therefore, was not carried out.

	Question 1		Question 2		Question 3		Question 4	
	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1	4.67	1	4	1	3.78	1	3	1
2	3.67	5	3.33	2	3.44	3	3.22	2
3	3.67	5	2.44	6	3.67	2	4.33	5
4	4	3	2.56	5	3.67	2	5.33	7
5	4.33	2	3	4	2.78	4	3.33	3
6	3.89	4	3.11	3	2.78	4	5.11	6
7	4.33	2	2.56	5	3.44	3	3.67	4

Table 4. Round 2 of the Delphi study

5. DISCUSSION

The completion of the two rounds of Delphi questionnaires took about five months. For each round of Delphi, reminder letters were sent by e-mail to the no respondents. Sometimes further reminder calls had to be made to convey the objectives of the study to the panel of experts. The results of the Delphi study presented here indicate that the most important factors are reduction of waste, followed by service and quality.

Sustainable procurement seeks to address the corporate decisions on sustainability in an integrative way. It posits that for companies to contribute to sustainable development it is desirable to measure corporate sustainable performance on a value based approach. While

there can be conflicts between the performance categories (Manoliadis and Tsolas, 2009) in BSC all aspects relevant in achieving a corporate competitive advantage are long been included. These characteristics of BSC can also be used for management sustainability criteria included together with the classical version of BSC, the so called Sustainability Balanced Scorecard (SBSC), since the classical method and has the advantages that is well known to a large number of companies (Figge et al., 2002).

6. CONCLUSIONS

As indicated above, there are numerous opportunities to enter the Greek and surrounding market for green products, services, and technology. On the ground experience in construction and other industries it has demonstrated that the local market readily adapts to sustainable solutions that can demonstrate return on investment

The application of indicators of construction industry development is not simply a data gathering exercise. It is an integral part of strategic policy development and implementation towards the improvement of the performance of the industry. This study systematically developed a set of key performance indicators (KPIs) to measure the performance of sustainable procurement, with the future aim of setting benchmarks. The development and testing of a PI framework is important because PIs pave the way for benchmarking.

This study has contributed to knowledge by developing and testing a PI framework for the construction industry. KPIs have been developed under the four perspectives: the customer perspective, the learning and growth perspective the internal-business processes perspective and the sustainability perspective.

Though this methodology is built for Greek construction companies it can utilized in many cases and organizations. By adopting this methodology it’s possible to achieve business success while operating in a socially and environmentally responsible way by achieving balance of financial, social and environmental objectives, supporting key stakeholders and motivating employees.

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