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# Sustainability as a procurement criterion for port investments

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Abstract. Ports are known to be one of the most polluting sectors, and therefore provide an opportunity to reduce emission significantly. Until now, the attention has been given to reduction of emissions in transport and shipping. The scope of research must expand to include port infrastructures, which should be made more sustainable. In many industries, sustainable purchasing and procurement is already integrated, but the procurement by port authorities for construction works seems to be lagging behind. The objective of this paper is to promote sustainable procurement, through preparing a tool, method or model that can be easily used by all stakeholders.

The research has been divided into four phases: Analysis, Synthesis, Simulation and Evaluation. In the first phase, i.e. Analysis, insight is gained in the processes for (sustainable) procurement of different institutions and stakeholders, e.g. governments, port authorities and contractors. In addition, the legal aspects of procurement are examined. In the next phase, i.e., Synthesis, a procurement model is set up. This requires a selection of procurement criteria based on Life Cycle Analysis, and a selection of weight factors to be assigned to the various criteria. The format and type of model too needs to be determined based on requirements such as flexibility, stability and user-friendliness.

During the third step, i.e., Simulation the model is tested using reference contracts from current or existing projects. The impact of different criteria can be examined in this manner and, eventually, the model can be adapted. In the last step, Evaluation and recommendations over the application of the model will be given.

**Keywords.** Sustainable Port Development, Infrastructure projects, Procurement, Life Cycle Analysis, Value management, Sustainable management, Contract forms, Innovation

# 1 Introduction

In 2006, the port of Los Angeles started the San Pedro Bay Ports Clean Air Action Program (CAAP): it was the most ambitious program in the world for cleaner ports. It led to emission reductions of 50 to 75 % in five years time for DPM,  $PM_{2.5}$ ,  $PM_{10}$ ,  $NO_x$  and  $SO_x$  (see Fig. 1). After this success more and more initiatives followed, like

#### PRIMARY POLLUTANTS DEFINED

DPIVI = DINOX = OSOX = OPM2.5 = PoPM10 = PoCO2 = C	esel Particulate Matter xides of Nitrogen articulate Matter less thar articulate Matter less thar arbon Dioxide (A Green I	n 2.5 microns in dia n 10 microns in dia House Gas contrib	ameter meter utor)
OVERALL	EMISSIONS REDUCT	<b>IONS CY 2005</b>	-2010
OVERALL	EMISSIONS REDUCT	CY 2005	-2010 15-2010
OVERALL	EMISSIONS REDUCT	1ONS CY 2005 CY 200 %	-2010 5 - 2 0 1 0 tons
OVERALL	EMISSIONS REDUCT Pollutant DPM	1ONS CY 2005 CY 200 % 69%	-2010 15 - 2 0 1 0 tons 617
	EMISSIONS REDUCT	1ONS CY 2005 CY 200 % 69% 70%	-2010 5 - 2 0 1 0 tons 617 579
	EMISSIONS REDUCT	10NS CY 2005 CY 200 % 69% 70% 69%	-2010 5 - 2 0 1 0 tons 617 579 678
OVERALL	EMISSIONS REDUCT Pollutant DPM PM2.5 PM10 NOX	C Y 2005 C Y 200 69% 70% 69% 50%	-2010 5 - 2 0 1 0 tons 617 579 678 8,180

Fig. 1 Emission reductions port of Los Angeles (Port of Los Angeles, 2011)

the WPCI (World Ports Climate Initiative) in 2008: a cooperation network of 55 ports in the world originated from the International Association of Ports and Harbors (IAPH) for reduction of CO2 emissions.

These initiatives are started since ports are one of the most polluting sectors while much reduction of emissions can be realized. Until now, the attention is focused on cleaner transport and shipping. This study broadens the scope to cleaner port infrastructure. For more sustainable infrastructure sustainable procurement criteria are needed. The goal of the study is to realize a procurement model with different criteria for more sustainability. This is done by a research which is divided in four phases: Analysis, Synthesis, Simulation and Evaluation.

# 2 Analysis

In this phase different topics are studied about procurement in general, the role of sustainable criteria in the procurement process, the commercial (dis)advantage of sustainable management and the visions and policies around sustainable port development. As a part of this analysis several parties<sup>1</sup> are interviewed about their views and policies.

### 2.1 Procurement Process

European ports are bounded to European laws and these ports are obliged to European public procurement above a certain contract sum and many port infrastructure projects sums exceed this value. When it is a matter of public European procurement Port Authorities have the choice for procurement with a selection based on the lowest price or the most economically advantageous tender. The last criterion is a criterion which selects the alternative with the best price-quality ratio. This can be realized by setting criteria for a more sustainable alternative.

One of the goals of this study is to make a project as sustainable as possible. In the procurement phase of a project it does not depend only from setting sustainable criteria. The choice for a type of contract is very important. Lately innovative contract forms, e.g. D&B and DBFM, are more popular. When using these types of contracts, contracting companies gain more freedom and influence in the design of the project. Therefore more different kinds of alternatives are possible which helps the sustainability. Besides, there are many innovative contract forms which include maintenance and engineering. In practice these developments has led to the applying of Life Cycle Analysis (LCA) by contractors leading to a higher value of the project (Sieswerda, 2010). This is an important property of a sustainable project design: projects should not only be sustainable for a limited period of time, but also during their whole lifetime.

### 2.2 Economical Effects of Sustainable Management

In most industries (especially industries in consumer markets) sustainable purchasing and procurement is already integrated, more than the port sector. According to the study of Adams (Adams, Quinonez, Pallis, & Wakeman, 2009), many port authorities approach sustainability in a negative way: sustainability is seen as a necessity for reducing external effects (e.g. emissions), instead of the optimization of advantages like retaining and attracting clients while other industries make use of these advantages of sustainable management. According to MIT and the Boston Consulting Group (Berns, et al., 2009) sustainable management has many commercial advantages which lead to a larger return for shareholders (see Figure 2). Ports should make use of these advantages and sustainable procurement is one of the possibilities to realize this. Using sustainable policies ports will get a better image which lead to a license to operate and a license to grow.

<sup>&</sup>lt;sup>1</sup> 2 large contracting companies, 2 port authorities, the government and a NGO



Fig. 2. Advantages of sustainable management (Berns, et al., 2009)

Besides advantages, sustainable and innovative operational management can have disadvantages. Most of these disadvantages have to do with uncertainties about the future due to the fact that in many cases sustainable investments are long term investments. A second disadvantage is the risks of investing in innovation. Private parties incline to make fewer investments in innovation due to the risk of spillovers of knowledge, investment risks and the differences in benefits between companies and the society in general.

#### 2.3 Analysis of Actors

By making an analysis of the views and policies of the different actors (e.g. governments, port authorities, contractors, etc.) involved in sustainable port development insight is gained in the interests and the importance of the different topics. One of these actors is the Dutch government which set different themes that are important in sustainable port development (Ministerie van Verkeer en Waterstaat, 2008). These themes include: use of space; mobility of the hinterland; development of nature; air quality; environmental management; energy, CO2 emissions and waist flows; water quality. Research company CE Delft has set indicators based on these themes to measure the sustainability of the Dutch ports (Faber, Nelissen, Verbraak, & den Boer, 2010), which can be used for setting sustainability criteria. Based on the themes there is made an inventory of the different topics of attention from the actors. The conclusion is that most attention is going to environmental management (e.g. cooperation in knowledge, use of environmental management systems, ISO14001) and energy, CO2 emissions and waist flows.

#### 2.4 Interviews

As mentioned before, different parties from the procurement process were interviewed. Here, the most important conclusions are picked from the results. Due to the number of respondents, a statistical conclusion cannot be made but the results are very useful to get insight in different views and solutions. There was consensus in opinion about some topics, but there were many topics with disagreement too. This shows that more research has to be done about this subject. Most respondents were of opinion that especially the large companies in the building sector see the (commercial) advantages of sustainable management. Small companies still link sustainability with extra costs. There was agreement too about the proposition that sustainability should come from the contractor instead of the awarding authority. But the companies gave very different answers to the question if contractors are given enough space to make this possible. All respondents were of opinion that owners choose contracting forms which give too little space for innovation. Together with the opinion that sustainability should come from the contractor the conclusion can be made that contractors do not have enough space to realize sustainable projects.

There was disagreement too about the question if there should exist a general procurement model for the whole soil, road and hydraulic building sector instead of a model that is focused on the project itself. As advantage of such a model the ease of application is mentioned. A disadvantage could be the lack of freedom and the fact that every project is different.

It was very noticeable that most respondents didn't mention air quality as an important criterion for sustainability, while air quality is the number 1 topic in the several sustainable initiatives of international ports.

### **3** Synthesis

In this phase of the research the criteria of the procurement model are set. After the choice of the criteria an evaluation method is chosen with weight factors for the criteria. These choices are based on requirements as flexibility, adaptability, stability, transparency and user-friendliness.

#### 3.1 Criteria

Before setting criteria, the question has to be answered which criteria will contribute to a more sustainable port infrastructure. To be able to answer this question a definition for a sustainable port is needed. In this study there is referred to the definition of the Dutch and Flemish environment organizations (Dekker, 2008): a port with an optimal balance between performance of business economics, utilizing the available capacity, limited use of space, minimal negative influence on the environment and a relation between port and hinterland. This is a very important definition for this study. To reach this eleven criteria are mentioned in the referred report. These criteria combined with the different indicators for sustainable ports set by CE Delft and the People, Planet, Profit definition of sustainability led to different themes which are important when approaching sustainable port development. Then, the themes are translated to indicators for port infrastructure after analyzing the application of the themes on infrastructure. After setting the indicators for the sustainability of port infrastructure, criteria can be formulated. This has led criteria divided in 3 classes based on Life Cycle Analysis: People, Planet and Profit. People contents the social criteria as corporate social responsibility, Planet consists the criteria for the environment, e.g. emissions and development of nature, and the Profit criterion will be formulated as the financial Net Present Value.

#### **3.2** Evaluation of Alternatives

After selecting different alternatives from the tender for the project, the alternatives have to be evaluated to determine the most sustainable alternative. There are different evaluation methods to assess the selected alternatives on the different criteria. In this study distinction is made between monetary evaluation methods, overview tables and multicriteria evaluations. Monetary evaluation methods can be a cost-benefit analysis or cost-effectiveness analysis. For these methods it is necessary to translate the different effects of the criteria to shadow prices. Sometimes this can be a disadvantage.

Another method is the use of overview tables as a Planning Balance Sheet, a Goals Achievement Matrix or a score card method. The first two methods are focused on the social effects.

Multicriteria evaluation methods (MCE) have the advantage that it can be applied on both quantitative as qualitative data. There are different types of MCE methods. In this study there is made a selection of the most used MCE methods in civil engineering: the weighted summation, the permutation method, a concordance analysis, multidimensional scale methods and the characteristic value method.

After making an analysis of the advantages, disadvantages and the applicability, an evaluation method is chosen. This method will be integrated in a computer program, e.g. a work sheet, in which the different effects and the most preferable alternative can be calculated.

### 4 Simulation

At the moment of writing of this paper this phase has still to be worked out. In the Simulation the developed procurement model will be applied to different tenders from the past for infrastructure projects in the port of Rotterdam. The impact of the different criteria can be examined. When necessary, the model can be adapted. This phase is a test for the stability, reliability and flexibility.

#### 4.1 Evaluation

The Evaluation consists of a study to the possibilities and restrictions of the model. Besides, research will be done to the possibility of adapting the model for applying to other types of contracts, e.g. land lease contracts. This can be very useful since it is plausible the companies that are using the port area (terminal operators, refineries, chemical industries, etc.) have the largest contribution to the total environmental effects inside the port.

At last recommendations will be given about the application of the model.

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